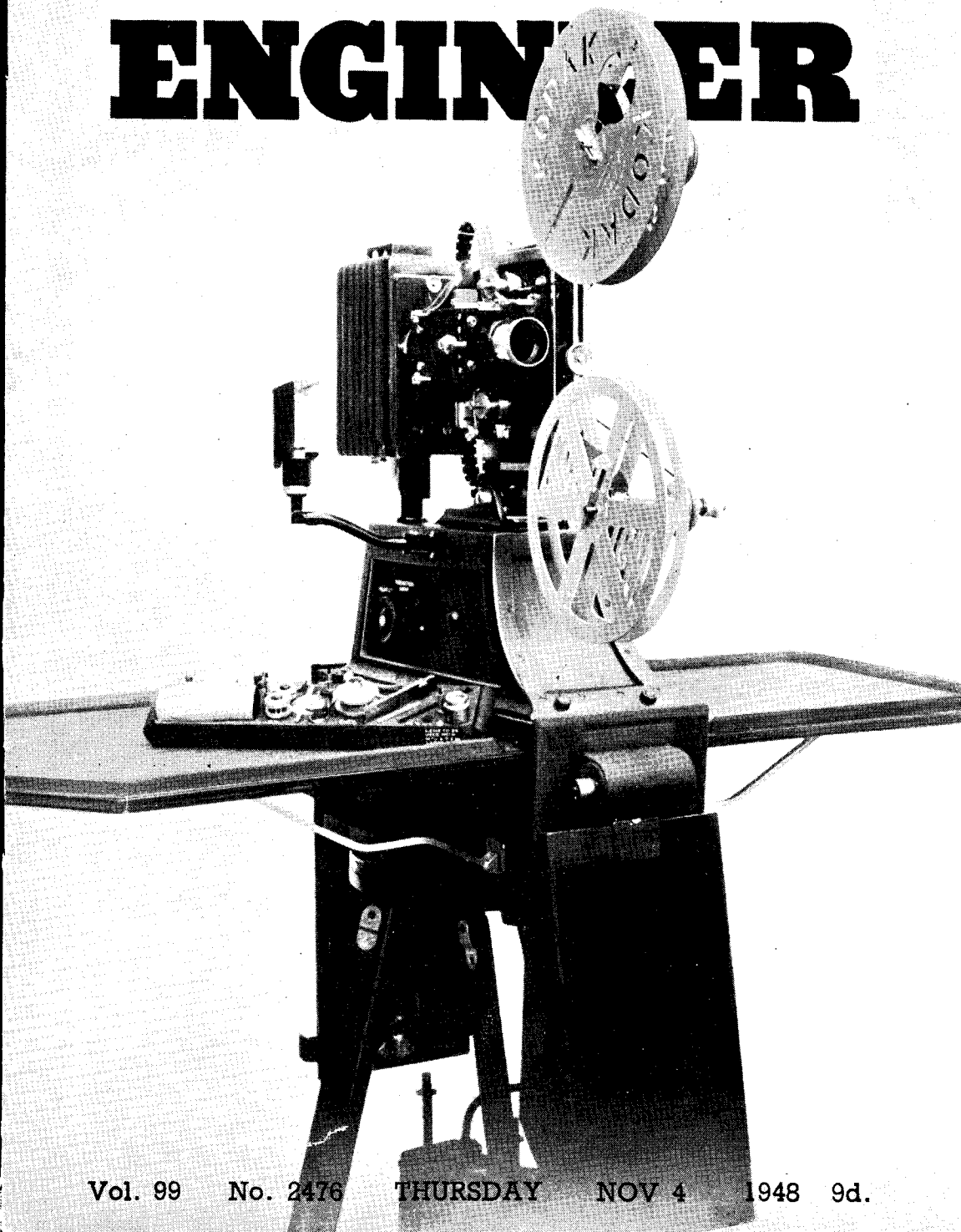
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

Help the Youngsters

● MR. L. M. BICKERTON, Curator of the City Library, Museum, Art Gallery and Old House, Hereford, has written to say that in May of next year there is to be held a Children's Week in Hereford. Friday, May 27th, will be devoted to talks on hobbies and model-making, with a view to arousing enthusiasm for these subjects.

There will be an exhibition of models made by Hereford children, and it is hoped to obtain a few really good models, made by grown-up enthusiasts, for exhibition during the week. If any reader is able and willing to lend a model, he is invited to get into touch with Mr. Bickerton at the Museum.—J.N.M.

What is Happening ?

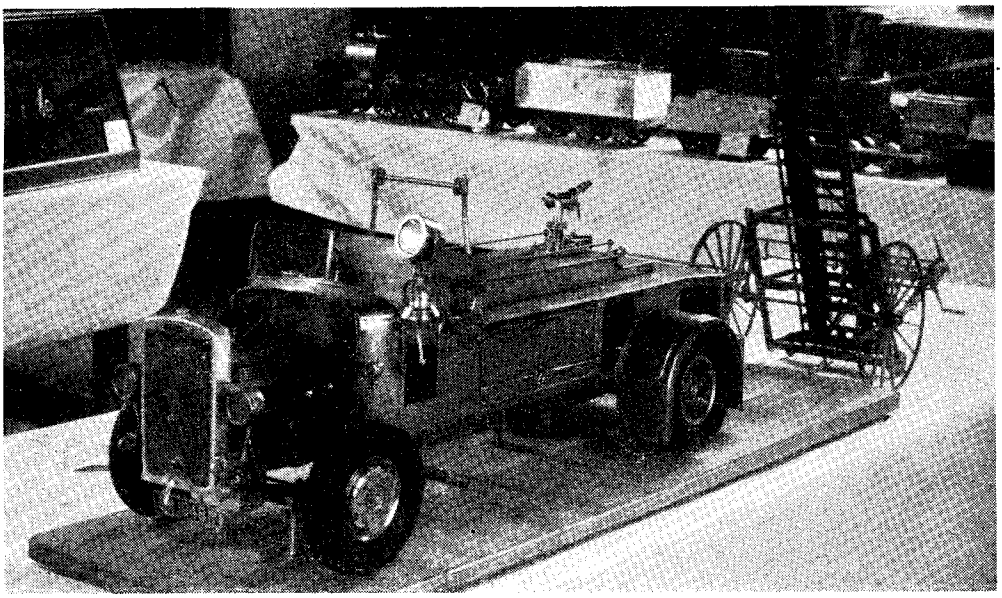
● MY NOTE about the British Railways Western Region locomotive, No. 7017, *G. J. Churchward*, was in the Press when the same engine gave me another surprise. I saw her on October 9th, at Paddington station, and noted that the name-plates had been removed ! So far, I have not discovered the reason for this. The engine had brought in the 7.45 a.m. express from Bristol, due at Paddington 10.10 a.m., and she took out the 6 p.m. Paddington to Weymouth train the same day. I have not seen her since, but I am wondering what surprise she will give me when I do see her again !—J.N.M.

Painting of Old Locomotives

● MR. P. R. WICKHAM, 49, Station Road, Countesthorpe, Leicester, desires to obtain all possible information about the styles of painting used for locomotives up to about the year 1850. Old coloured prints and models in museums are obvious, though frequently dubious sources of information of this kind. If any reader happens to be in possession of any authentic particulars, or can make useful suggestions as to where they could be obtained, he is invited to communicate with Mr. Wickham at the above address.—J.N.M.

Harrow and Wembley S.M.E. Exhibition

● WITH A report of the very successful exhibition organised by the H. & W.S.M.E., Mr. L. J. Lawrance, the society's Public Relations Officer, sent some photographs, two of which are reproduced on the next page. They show, respectively, Mr. S. A. Walter's Fire Engine and Escape and Mr. M. C. Payne's 15 c.c. Petrol Engine, both of which won the Cup in their respective classes. They may be taken as typical of the very



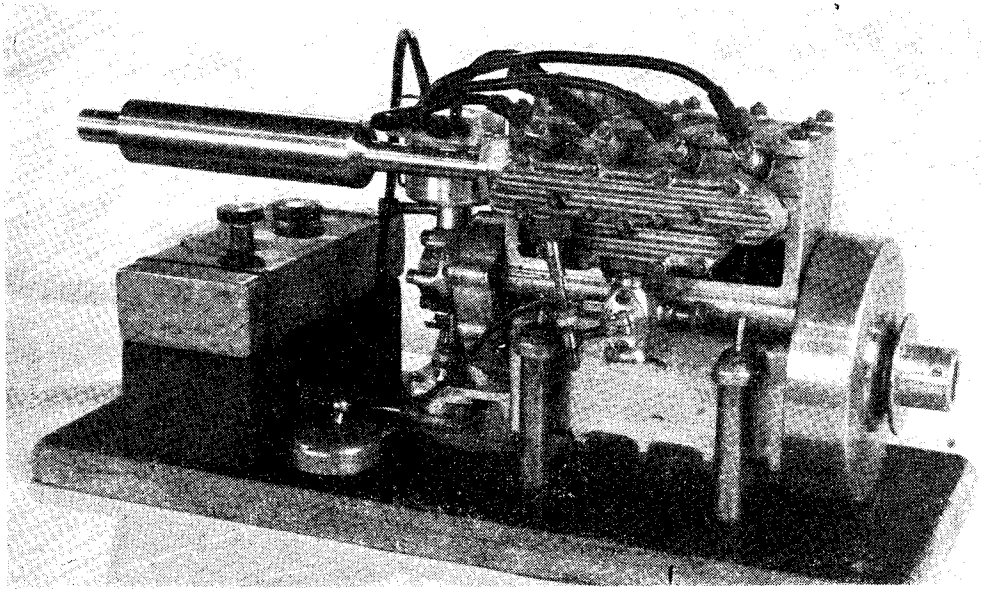
Mr. S. A. Walter's model fire engine and escape

high standard of work that was the key-note of the exhibition.

Mr. F. Cottam's ¾-in. scale G.W.R. "King" class locomotive won two Cups in its class—Open Cup and Challenge Cup—well-deserved awards which, probably, caused no surprise!

There is little doubt that the general standard of amateur workmanship is very high this year, and the outstanding models at most of the exhibitions have been *really* outstanding. There may be some very good reasons to account for this, but I hope it means that a real and permanent improvement is setting in. I am sorry that I was not able to visit the H. & W.S.M.E. exhibition personally, but judging by this year's report and my recollection of previous exhibitions, this society's record is marked by steady progress.

—J.N.M.



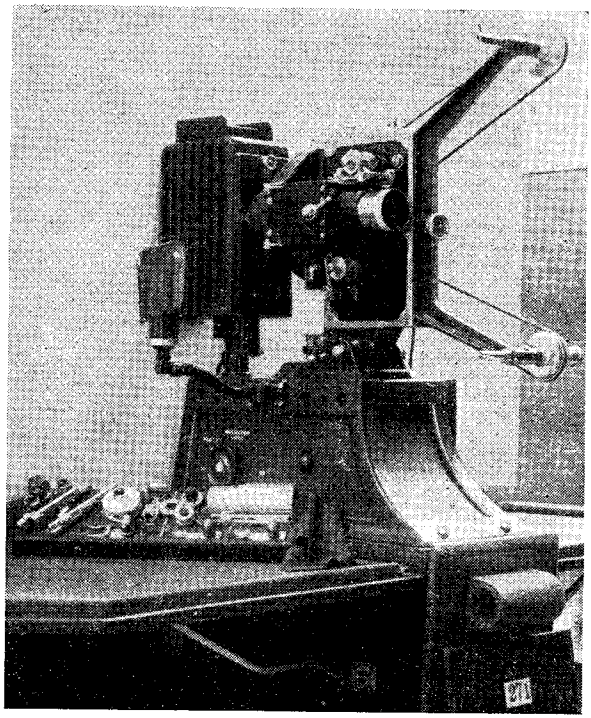
Mr. M. C. Payne's (Edgware S.M.E.E.) 15-c.c. petrol engine

"M.E." Ciné-Projector Developments

by "Kinemette"

IT is now nearly twelve years since the design of the "M.E." Home Cine-Projector was first introduced to readers, and in that time, a very large number of these machines have been constructed, almost invariably with highly satisfactory results. There have been a few criticisms, mostly in respect of matters which were beyond the direct control of the designer, such as the supply of components in conformity with the specification, and of sufficiently high quality to meet the exacting requirements of constructors who were not satisfied with anything below the standard of the most expensive commercially-made machines. But on the whole, it may be said that the projector has more than fulfilled the purpose for which it was originally designed, and the fact that the design is by no means obsolete yet is proved by the interest taken in it in post-war years; many machines are known to be under construction at the present time. The supply of castings and parts for the projector has for several years been in the hands of Messrs. Roox Products, of Alton, Hants, who have done their utmost to maintain not only the supply but also the quality of all components, despite difficulties which will be obvious to anyone with a knowledge of the instrument and optical supply trades. Many of the items originally specified for use in the projector are quite unobtainable at the present time, or are prohibitive in price to the average constructor, and it has been necessary to provide the best possible available substitutes.

A machine following the general design, both mechanically and optically, of the "M.E." Projector, but elaborated and improved in detail, was exhibited by Mr. W. H. A. Tayler, of Kingston-on-Thames, at the "M.E." Exhibition this year and was awarded a special cup presented by Roox Products, in addition to a bronze medal. A photograph of this machine is reproduced here, and the same exhibit forms the subject of this week's cover picture.



Mr. W. H. A. Tayler's improved "M.E." Cine-Projector

When the "M.E." Projector was first designed, it was stated that the question of adding sound equipment had been considered, and would be the subject of further experimental development in the future. From the purely mechanical point of view, the machine satisfied the essential requirements of a sound projector, being particularly robust, steady and silent-running; but in order to retain simplicity and economy from the constructor's point of view, it was decided to incorporate only the parts necessary for a silent projector, though allowing flexibility for later modification as a sound projector if and when considered desirable. A good many experiments have been made in the adaptation of the machine in this way, but while these have not been without reasonably successful results, the writer has not felt justified in publishing details of special sound equipment for the projector, mainly because of the difficulties and expense involved in the essential extra components required in the conversion.

It should be borne in mind that the "M.E." Projector is intended purely and simply as a machine for the amateur constructor, and it is most essential, for the success of the design, that any components required in its construction should, preferably, be capable of production by the limited equipment of the average amateur, or, as an alternative, readily available at a cost which is within his resources—bearing in mind

that few people will be prepared to spend large sums of money on projects of which the outcome is not 100 per cent. certain, which must necessarily apply to every home-produced model, however good the design or the ability of the worker. So many things may intervene to interrupt or upset the progress of a constructional venture, even in the best regulated workshop, and a job on which considerable money has been laid out, and which cannot be finished for any reason, becomes both a disappointment and an embarrassment.

It is for this reason that no design has been published for a sound-equipped version of the "M.E." Projector, though this does not preclude the possibility of doing so in the future; at least one essential item of the equipment, the photo-electric cell, has for some years been almost completely unobtainable, except to those with special facilities in this respect, and although matters now show some signs of improvement, it is still a very expensive item, to say the least. In addition, the optical equipment of the sound head involves further expense, and still more is entailed in extra mechanical parts, constant-speed drive, and sound amplifying equipment. The general conclusion—which is open to correction by prospective constructors if in error—is that the number of people who would be prepared to carry out such a project would not justify the trouble taken to prepare a special design, or to guarantee the supply of essential parts. The many readers who have written enquiring about the possibility of adapting the "M.E." Projector to sound will no doubt be disappointed at this decision, but they will, it is hoped, accept and appreciate this explanation of the practical difficulties involved.

There have, however, been several successful adaptations of this nature carried out by readers, and it has been possible recently to obtain some particulars of a successful sound projector constructed by Mr. A. S. Holmes, of Rugby, utilising the optical and mechanical system of the "M.E." Projector, including castings and other components supplied by Messrs. Roox Products.

The conversion consists mainly of the fitting of an entirely new base, incorporating the mechanical and optical system of the sound reproducing system, also the driving motor and cooling fan, the latter being necessitated by the use of a high-power projection lamp, and having nothing to do with the sound equipment as such. It was found desirable to mount the lamphouse and motion housing directly upon the base, eliminating the articulated trunnion joint which allows for independent tilting adjustment of the upper assembly, this facility being, however, provided by jack screws under the front of the base.

As may be seen from the photographs, the sound head follows fairly conventional principles of design, incorporating a scanning drum equipped with a flywheel to ensure steady running, over which the film passes after leaving the take-up sprocket of the optical system. An 8-volt 32-watt exciter lamp is employed, in conjunction with an optical unit consisting of a condenser, slit, and objective lens, to throw a beam of light through the film on to the photo-electric cell, which is of the BTH PE7 type, enclosed in a light-proof casing and mounted in sorbo rubber to damp out vibration, which might result in parasitic noises. The lenses in the exciter system were supplied by Messrs. Cineluxe Ltd., Leigh-on-Sea, and comprise a condenser of $\frac{5}{8}$ in. focal length and an objective of $\frac{1}{4}$ in. focal length; the slit is built up by clamping two razor blades in a small holder. Focusing adjustment of the objective is provided, to enable a sharp image of the slit to be projected on to the sound track of the film, the lateral position being adjustable by mounting the casing of the exciter lamp on a hinge.

All the sound-head components are mounted on the base, which is fabricated from $\frac{1}{8}$-in. sheet brass, including the gearbox in which the scanning unit, comprising the drum and flywheel, in a ball-bearing housing, is mounted so as to be readily removable as a complete assembly. The bearings used are of the Hoffman type, $\frac{1}{4}$ in. bore by $\frac{3}{4}$ in. outer diameter. A damping roller, rubber-faced and spring-loaded, also fitted with a friction device, holds the film in contact with the scanning drum.

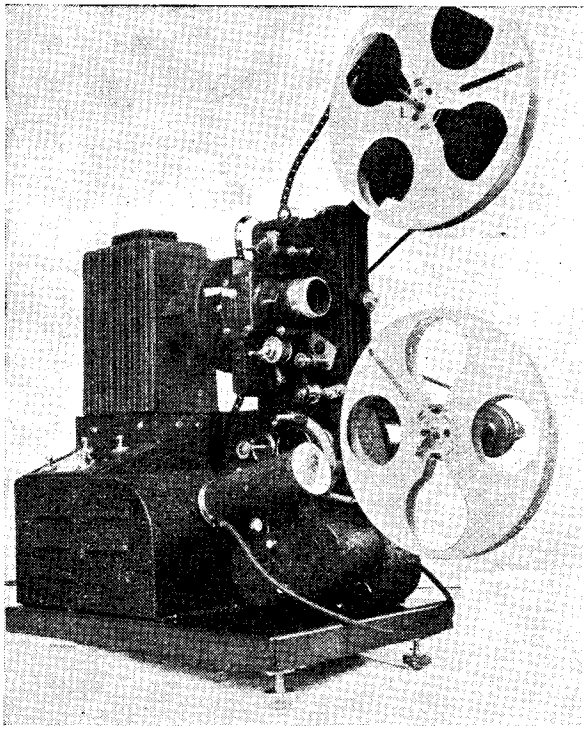
At the rear of the base, a casing made from sheet iron 0.025 in. thick houses the driving motor and its condenser, also the cooling fan, which draws air through the louvres of the casing and directs it upwards into the lamphouse. Fan cooling is generally considered necessary in cases where a high power illuminant is employed, and this machine uses a 300-watt lamp, the current to which is supplied by a home-made transformer, the secondary being tapped for the exciter lamp voltage. Switches on the casing provide separate control for the lamp transformer, driving motor, and amplifier.

The motor is of the a.c. induction-capacitor type, by BTH, producing 1/20 h.p. at 1,400 r.p.m. Mr. Holmes states that a somewhat higher speed would be desirable, but presumably this can be arranged by modifying the driving gear, providing that the motor develops sufficient power. Other modifications suggested as necessary or desirable to the main parts of the projector are as follows:

The motion spindles should be not less than $\frac{1}{4}$ in. diameter, including the sprocket shaft and the camshaft; although the latter has been made to the specified size, $\frac{3}{16}$ in., and no trouble has been experienced, it is considered that a larger shaft would be desirable. (Note, however, that the shaft sizes and bearing areas as designed for the "M.E." Projector are already larger than those of many commercially-produced sound projectors.) The lower sprocket guide roller has been replaced by one designed to produce tangential pressure on the film as it comes off the scanning drum. A double claw is desirable to reduce the strain on the film perforations—but it may be pointed out that except for the increase in the rate of film travel (from 16 to 24 frames per second), no extra strain is imposed by the addition of the sound head. A redesigned gate, with improved pressure and guide plates, has been fitted, with relieved tracks to reduce film wear, and a modified position of frame aperture. It is possible to reduce the surface pressure on the gate by fitting side springs, bearing on the edges

of the film, but these must be kept well away from the aperture to prevent distortion of the film and thus upsetting the focus.

Since the photograph of the machine was taken, new spool arms, to take 900-ft. spools, have been fitted, and the existing take-up friction clutch takes the extra load imposed without trouble. The machine is used for the projection of 9.5-mm. sound films, but is equally applicable to 16-mm. films, using the specified modifications to the gate and sprockets, similar provision being required to adjust the track of the sound head.



A sound projector by Mr. A. S. Holmes, using optical and mechanical components of the "M.E." Projector

A few words on the general design of cine-projectors may be appropriate to conclude this article, as the interest taken by readers is apparent from the number of times it has been referred to in the "M.E.", both by contributors and correspondents. Apart from the optical and illuminating systems of the projector, both of which follow the same principles as other optical projectors, and are dependent mainly on the quality of the components available, the most important part of the machine from the constructor's aspect is the mechanical motion of the film shift and shutter gear. There are many highly ingenious forms of this gear, some of which offer advantages, at least theoretically, in the more rapid shifting of the film, thereby enabling the shutter aperture to be widened and more illuminating efficiency to be thus obtained. Generally speaking, however, the amateur constructor will do well to steer clear of elaborate mechanisms, because they are not only more difficult to produce, but also less satisfactory in service, in many cases.

The true practical test of any intermittent mechanism is its mechanical efficiency, and the way it stands up to normal (or in some cases, abnormal) conditions of service. In this respect it is very difficult to find anything better than the cam-operated claw, which in various modified forms is by far the most popular type for sub-standard machines, and is retained by some of the best makers, in spite of the claims of the latest improvements in intermittent motion gear.

The Maltese-cross type of motion, almost universal in 35-mm. projectors, is much less suitable for sub-standard films, which have only one perforation per frame, instead of four in the case of the larger film. As a result, it is necessary to use an intermittent sprocket having not less than eight teeth, necessitating an eight-station "cross" which is far more difficult to make accurately—and the difficulties of the normal type of "cross" in this respect are already so great as to call for the very highest possible precision equipment in production. Inaccuracy in this member, or in the cutting of the sprocket teeth, result in objectionable up-and-down float or flutter of the projected picture. On the other hand, minor inaccuracies in a claw mechanism will not affect the steadiness of the picture, because so long as the claw enters the perforations of the film without damaging them, it must always stop at the same place at the end of its stroke.

It is often thought that the "dog" or beater type of film-shift gear simplifies construction of a projector, but this is really a fallacy. A little thought will show that this gear can only give a truly accurate film shift when the take-up sprocket, and the gearing which drives it, are made to precision limits, as these components, and not the beater (unless the latter is of special and elaborate design), really determine the position of the film in the gate at the end of the beater stroke. This form of motion will often deal with films having broken perforations, at least for a time, and in the early days of motion pictures, 35-mm. machines having this motion were in demand by travelling showmen who had to use old and damaged films. But this advantage is only temporary, as the snatch on the film produced by this gear is heavy, and often results in tearing out a few more perforations, in cases where the film is already locally weakened. In this respect, not only the beater gear, but any form of motion which gives an exceptionally rapid shift, may be found to produce excessive wear and tear of films.

There is scope for experiment in shutter

(*Continued on page 476*)

Locomotives Worth Modelling

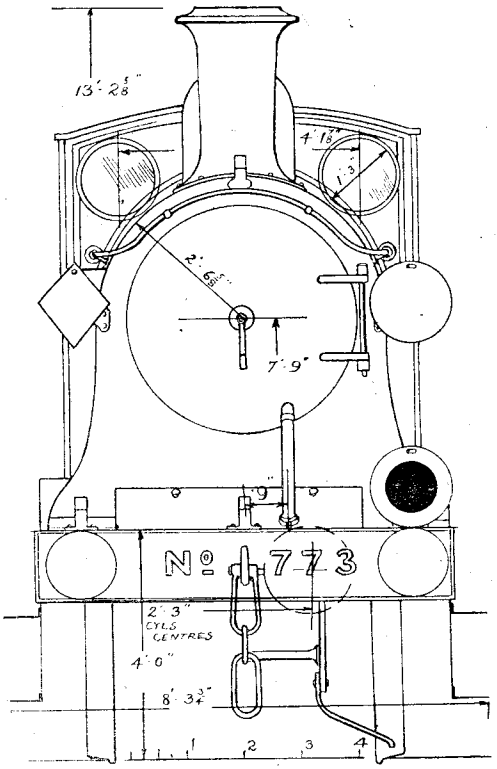
by F. C. Hambleton

No. 28—L. & S. W. Railway, No. 773

WHEN I was describing the monster "1400" class of the L & Y. Railway (affectionately dubbed "Tinies" by the enginemen themselves) I mentioned how Dugald Drummond, in an attempt to squeeze a really large firebox between the coupled axles, had boldly set them as far apart as ten feet. This meant a giant coupling-rod indeed for his new engine, No. 702, which was built at Glasgow by Messrs. Dubs & Co. at the very same time as No. 1400 herself was being completed at Horwich. But the designer kept the throw of these long rods down to 9 in., and although they were not of unusually large section no cases of bending or snapping were reported, despite the very high speeds often attained by the 702 class.

These grand "Sou'-Western" engines were full of sound details, and merit attention from the model-maker, so let us interrupt the Atlantic theme for a moment and have a glance at these Scotties. They were numbered from 702 to 719 and 721 to 732, the maker's numbers running from 3746 to 3775. Messrs. Dubs built yet another one specially for the Glasgow Exhibition of 1901, and she was numbered 773 (Dubs' number, 4038). She was then sold to the L.S.W.R., and took her place with her other sisters down South. Apart from her number, she could be singled out by the little gilt ornaments that decorated the centres of the coupling-rod splashers, and by the white line painted round her buffer-beam. No. 773 looked very fine at the Exhibition, but what attracted one almost equally was the really wonderful sectional drawing that accompanied the engine. It was executed by a draughtsman of draughtsmen, Mr. Hunter, who accomplished a veritable work of art. It was inked-in with the finest of black lines, and delicately shaded in pale washes of colour, the gradations of shade being quite perfect. Dimension figures, lettering, curves, all were of a standard recalling the older Stephenson school of draughtsmanship, the whole achieving a superb effect. It is a pleasant thing to know that this glorious drawing is now preserved at South Kensington Museum, although, at the moment of writing, not yet on view to the public. More's the pity, and I only hope the authorities will soon see their way to rehang it on the walls of this treasure house.

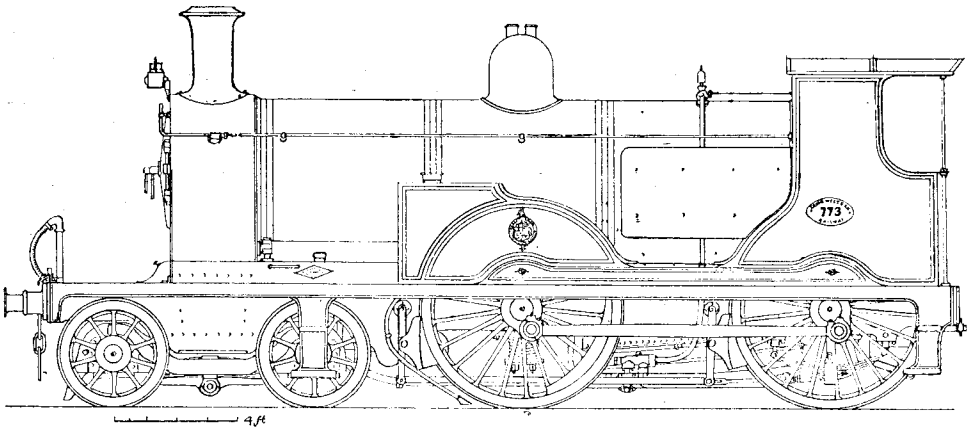
No. 773 was a pedigree engine, for she could trace her ancestry away back to the first 4-4-0,



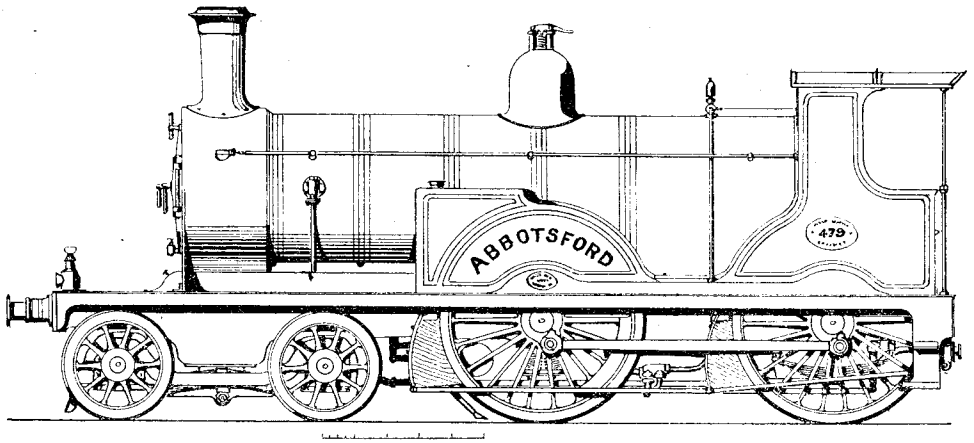
The Exhibition engine on a "Special" train to Portsmouth

Abbotsford, that Drummond had designed for the North British Railway. He had taken the design with him when he migrated to the Caledonian, and now, once again, he brought it down to London, to Nine Elms works, for all the world to see. Meanwhile the Holme's N.B. Rly. 4-4-0's, and the McIntosh's *Dunalastairs* were near kinsmen. When one examined No. 773 in closer detail, one could see how deeply Stroudley's ideas had sunk into Drummond's mind during his short stay with the great chief at Brighton in those first stirring and romantic years.

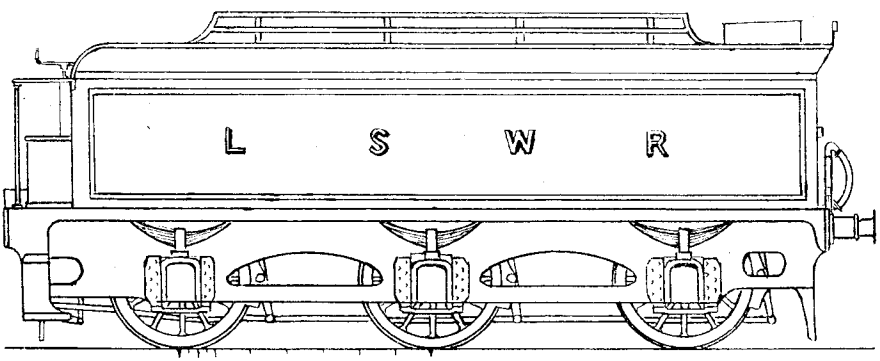
Peep inside the cab, all neatly grained and gleaming with polish. There was the double-handled regulator, the couple of gauge glasses close to each other, the same type of firehole door (only easier to manipulate than the Brighton pattern). The cab pillars looked familiar, by jove they did—ever seen *Gladstone's*?—and the same tidy and simple layout of the cab was to be observed. The whistle was much like Stroudley's, only the push valve was simpler in construction, but the note not so melodious, alas! The connecting-rod big-ends were of a modified "Marine" pattern, and the eccentric pulleys had lugs on them which engaged with the crank arms. There was even a hand-lamp perched up by the motion-plate! But this spectacle-plate was a far heavier casting than the



One of Drummond's finest engines was No. 773, exhibited at the Glasgow Exhibition in 1901.



The first Drummond 4-4-0, built for the N.B. Rly.



The Drummond tender resembled its engine in having a long wheelbase—14 ft., equally divided

When the scores were removed, a narrow surface-plate was applied and scraping started. The fixed gib-strip was, by the way, in excellent condition as to surface.

As soon as the surface-plate showed a reasonably distributed general bearing, the saddle was transferred to the bed, which, of course, had already itself been scraped to surface-plate.

Scraping was continued until a satisfactory bearing was obtained on the two flats and the Vee-gib.

The taper strip for the back-gib hardly needed touching, but it did need a packing strip, and,

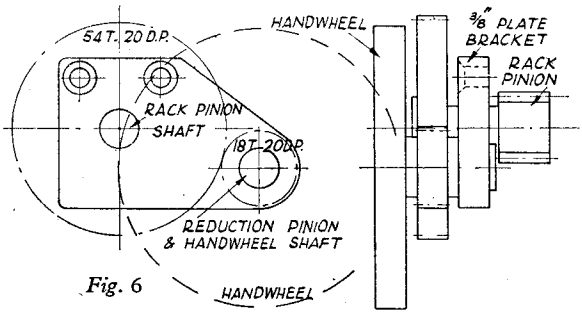


Fig. 6

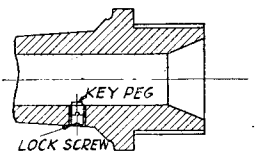


Fig. 8

of course, the amount taken off the bed top and off the saddle bottom, plus its own wear, had made it so slack that its adjustment was completely outrun.

A piece of hard rolled brass 0.030 in. thick was used for this ; it acts, of course, purely as a packing and is not subject to any wear or relative movement. The fitting of this packing strip resulted in the original adjusting screw-head failing to mate with the recess in the main steel strip, and as to put this right would not only have entailed a new screw with a larger head, a comparatively minor matter, but a tricky machining operation in enlarging the recess in the saddle casting, I altered the arrangement altogether, as shown in one of the photographs.

In refitting the " apron " I decided to alter the rack traverse arrangements already described. Fig. 6 shows what was done ; a three-to-one reduction gear 54 and 18 teeth D.P. was made and fitted ; the wheel was gunmetal and the pinion steel. This cured both the faults I have referred to and I regard it, for my own requirements at any rate, as a great improvement.

Incidentally, the original pinion, shaft and bush were almost unbelievably worn. Fig. 7 is a photograph which shows them, but they really had to be seen to be believed ; just to help matters, the handle was very loose on the spindle and its two parts loose with each other. It had apparently had no oil or grease for years, yet proper oiling facilities were there to use.

The new pinion and shaft were made from silver-steel, and, incidentally, I had to get the teeth cut outside, as they were a " Module " pitch and I had no suitable cutter available. The original balanced handle was replaced by a 4½-in. diameter cast-iron disc wheel with a single handle. I prefer a wheel to a balanced handle. The wheel came from an odd piece of scrap and the handle was turned from a bit of ⅝-in. diameter B.D.M.S. It is held to the wheel by a ¼-in. 40 t.p.i. nut.

As will be seen from the photographs, this wheel is at the tailstock end of the saddle, which is the usual place for this feature in lathes of English manufacture. American lathes, on the other hand, nearly all place this at the headstock end.

I greatly prefer the English practice, as I like to use the right hand for traversing and the left for manipulating the cross-slide. There is a more important factor, however : placed at the headstock end the left hand gets the full benefit of hot turnings, which, with a power-driven lathe are frequently extremely hot.

The British arrangement entirely avoids this and the operative hand is well clear of these unpleasant customers.

The compound slide-rest was next dealt with, so far as its slides were concerned, by the same methods as described for bed and saddle.

Slack was taken up in the feed-screws, though, due to wear in the nut of the cross-slide feed-screw, it was not possible entirely to eliminate backlash. The wear, however, was not sufficient to make it worth while making a new nut. That would have meant making special taps or a very tricky screwcutting job, as the screw is " Acme " form thread only ⅜ in. diameter and the nut is nearly 2 in. long ! Handles were squared up, indices cleaned and polished surfaces reconditioned, burrs filed off and everything possible done to make as good a job as possible, both from a functional and appearance point of view.

Quite a lot of fun and games were had with the headstock.

The bearings were not bad, in fact, the bushes and the rear journal were practically perfect, in spite of obviously having been starved of oil for years. The front or main journal was scored to a small extent, but, by careful honing and subsequent lapping, was brought back into, if not perfect, thoroughly sound condition.

The keyway in the mandrel into which the locking plunger fitted was badly worn, and it was opened out, a filler strip fitted and fixed, and afterwards smoothed off flush to the contour of the mandrel itself, a new keyway being cut on the opposite side ; the plunger itself, being hardened, was in perfect condition. A stronger spring had to be fitted behind it, as at the higher speeds centrifugal force was sufficient to cause it to overcome the compression of the original spring and fly out of gear.

When the headstock was stripped, it was discovered that at some previous period a mechanical gangster had removed the ball-thrust bearing (it had probably been damaged) and replaced it by a plain brass washer which did nothing except fill up a bit of space! It had no function at all, as it touched neither the mandrel nor the face of the bearing bush; in consequence, any thrust was taken by the long cone of the main bearing, which, of course, promptly resulted in the lathe pulling up.

The thrust-race was a standard size but could not be obtained from stock.

As a temporary measure, a thrust bearing was made up from two bronze washers with an intervening "Tufnol" washer—the bronze washers have shallow oil grooves on the faces which mate with the "Tufnol" washer. "Tufnol" has the right physical properties for the purpose, and, being non-hygroscopic, is unaffected by changes in atmospheric conditions.

The back-gear assembly was in excellent shape, and, beyond a thorough clean up and a good oiling, required no attention whatever.

A short lever was added to the back-gear operating knob to facilitate handling and a stop provided to ensure correct location.

The peg key which locates the collets was "amongst those missing," apparently it had "fallen off."

A new one was made from silver-steel, hardened and tempered dark straw; Fig. 8 shows how it is arranged.

New lubricators of the wick-feed type were made.

When reassembled and adjusted, the mandrel had that feel which is best described as "silky." The tailstock only called for the usual removal of burrs and scratches, tightening, and squaring up the handle and trimming up the Morse taper socket in the barrel. This was done by pushing a No. 2 M.T. reamer into the barrel, putting the four-jaw chuck on the headstock, advancing the tailstock until the square of the reamer entered the jaws, locking the tailstock to the bed, screwing up the chuck jaws sufficiently to turn the reamer *without* gripping it (i.e. letting it float), putting in back-gear, turning by hand and gently feeding up tailstock barrel, cutting-oil, light cuts, frequent withdrawals, and care, resulting in a smooth and accurate recess once more. The screwcutting gear was in very good condition and, beyond cleaning and adjustment, required nothing doing to it. The fixed steady (see photo) was sound, but every one of the adjusting screws was bent and had to be straightened, and the usual burrs and scratches dealt with. I formed the opinion that the tools used for adjusting the lathe had been coal hammer, chisels (assorted), "footprints," and pipe tongs. There was one spanner with it which did not fit anything!

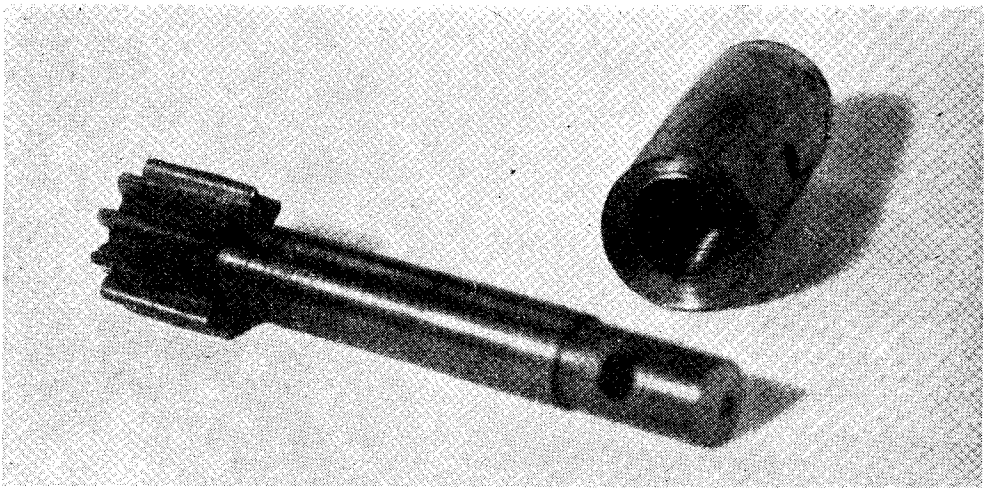


Fig. 7. The old racking pinion and bush

Many of the nuts and screws are hardened, otherwise damage would have been much worse.

Before reassembly, a concentric hole $\frac{3}{8}$ in. diameter was bored about 3 in. up the outer end of the lead-screw, in order that when desired a graduated disc might be mounted for longitudinal dividing work, the disc being mounted by an expanding mandrel inserted in the hole. I am contemplating making a detachable hand-feed arrangement to act either direct or with a 50 to 1 reduction, similar to that fitted by the late Geo. Adams to some of his own lathes, but that will have to wait awhile.

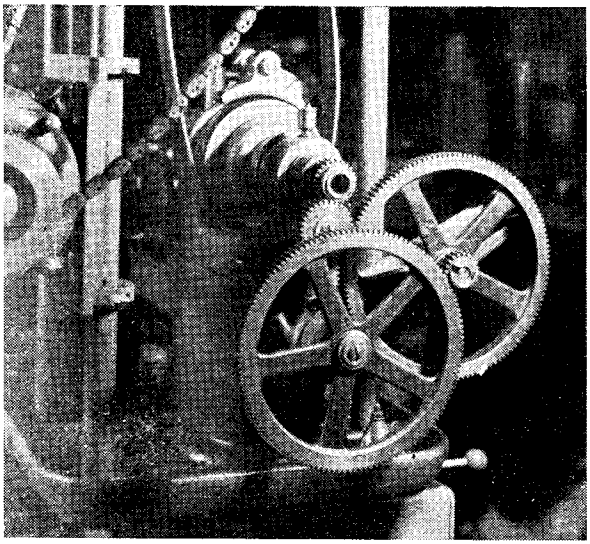
The arrangement of the self-contained drive which I have fixed up will be obvious from the photographs, the countershaft runs on "N K A" ball-bearings and the lever at the left-hand front corner serves to tension or slack the belt, acting as a clutch and so saving the necessity to switch the motor on or off every time one requires to start or stop.

There is quite a lot of momentum in a free-running mandrel of this kind, and as a time-saver

I have fitted a hand brake with a leather-faced shoe acting on top of the large belt cone, and operated by a lever depending in front of the headstock, the unit being carried on the back-gear cover. This arrangement, too, will be clear from the pictures.

The stand has a shelf and drawer, and partitions for change wheels.

These were badly worn; in this case, perhaps, there was some excuse, and I scrapped them and made a new fix-up slightly different to suit my own ideas.



Rear end gears set up for fine feed. Motor to left. Note brake on large step of cone and reversing switch at bottom right

I obtained a Jacobs ½-in. drill chuck and mounted it on a No. 2 M.T. shank for the tailstock, and out of another No. 2 M.T. shank I made an adaptor for the 8-mm. range of collet chucks; an adaptor was made for these for the mandrel, too, and a special drawbar to suit.

All the old paint was cleaned off, and after a filling coat (well rubbed down) and a priming coat, a coat of grey enamel was applied, which gives a most pleasing result.

I have fitted a tool-post of my own design, one which I have previously described, and I have also made a four-way turret toolholder.

The job has been a most interesting one and, I feel, thoroughly worth while.

The lathe is now once more capable of doing real precision work, and, if properly looked after, is good for many more years' work than it has already done.

The present speed range is from 2,100 down to about 130, 12 speeds.

A two-speed pair of grooved pulleys take the drive from the motor. The pulley on the countershaft is a temporary wooden one, but as soon as possible it will be replaced by a similar sized one in metal, but incorporating a concentric 2 to 1 reduction gear which can be put into action or locked solid with the pulley at will. This will double the range of speeds available and drop the lowest speed to 65 r.p.m.

A detachable sloping backboard to carry chucks, face and driver plates, centres, etc., is mounted by means of clip brackets on the tray. Other accessories are carried on the shelf below or in the fitted drawer below this.

The whole unit is absolutely self-contained, and by disconnecting one cable and taking out four large woodscrews can be moved *en bloc* wherever required.

Just a final word about wear and tear. With the average amateur's lathe this should be extremely small over long periods, for the usage of such a lathe rarely averages more than a few hours a week. The chief cause of wear is swarf and dirt getting under slides and into bearings, combined with lack of proper lubrication to moving parts. Wherever possible, sliding surfaces should be covered, where not, they should be protected by well-fitting felt wipers which should themselves be cleaned or renewed at regular intervals. Keep things properly adjusted, see that your mandrel bearings are continuously lubricated with a pure thin oil (a thin oil makes a lot of difference to the power absorption at high speeds), see that feed-screws are kept lubricated and free from swarf, clean sliding surfaces regularly (I keep a small whisk brush handy and use it frequently to clear cuttings off bed and slide-rest) particularly when machining cast-iron, *don't* blow chips off either with the mouth or compressed air, that is just the way to force them under slides. If you follow these simple principles, even a cheap lathe will give long wear-free service, whilst a really good one will last a couple of lifetimes. My Adams-Pittler has already served one owner continuously for 45 years and it is as good today as it was when it was made; I say that after having stripped it right down and found practically nothing to do to it, even in the way of adjustment. Original scraper marks, even on the bed, are still visible, not because the lathe has not done a lot of work, but because it has been excellently cared for—machines, like animals, respond to good treatment.

Addendum

Since drafting this article, certain additional work has been undertaken, including the fitting of new indexed thimbles on the slide-rest feeds. The feed-screws are 2 mm. pitch, and 2 mm. represents 0.078 in., so that 78 divisions will give 1/1,000 in. advance (the figure is not exact, being 7/10,000 in. short on a complete revolution, but for all practical purposes it is perfectly satisfactory and it is on the safe side, anyhow, 1 division advance resulting in a reduction in diameter of 0.00198 in. instead of a nominal 0.002 in.).

Actually, the old index thimbles were used, the original engraved portion having a suitably sized ring forced on. The engraving was carried out on a "Quickset" dividing apparatus, which

(*Continued on page* 485)

IN THE WORKSHOP

by "Duplex"

23—A Two-tool Back Tool-post

SINCE we briefly described a simple type of two-station back tool-post in Article No. 7 in the March 25th issue, we have had so many requests for further information as to how this device can best be constructed, that we have decided to give full instructions for making this useful attachment.

As many will be aware, when the tool is used in the inverted position at the back of the lathe, parting off is greatly simplified and, in addition, heavy chamfering cuts can be taken with much less tendency to chatter.

When the fitting of a tool-post of this type is contemplated, the first point that arises is whether it is applicable to the lathe in question. This will depend mainly on the length of the cross-slide; for if the attachment is to remain in place on the saddle, as it should, sufficient room must be left between the tools in the front and back tool-post to allow all ordinary turning to be carried out. We have fitted this tool-post without difficulty to the Myford 4 in., M.L.7 and Myford Drummond lathes, and no doubt it can be used with many others of approximately similar dimensions.

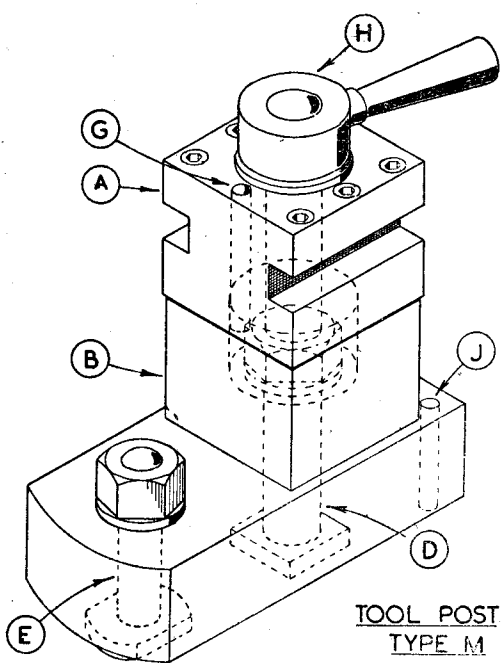
In practice, it is found that a gap of 1½ in. between the points of the tools in the front and back tool-posts is sufficient for comfortable working, but if at any time more room is needed here, either the turret of the back tool-post can be turned into its sideways position to get the tools out of the way, or the attachment as a whole can be removed by merely slackening its two securing bolts.

It is advisable, therefore, at the outset to make sure that the length of the cross-slide is sufficient to afford ample working space between the two sets of tools.

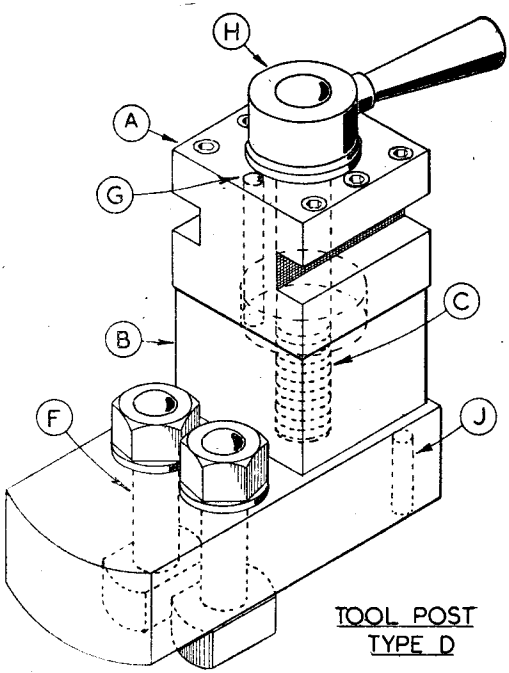
The two-station tool-post was designed in the first instance to carry a parting and a chamfering tool for turning steel, but those who habitually work in both brass and steel can either mount two parting tools suitable for machining these metals or, by the provision of an extra turret, the set of tools can be quickly changed at will for turning either material.

The original tool-post was built up from mild-steel stock to fit our own lathe, but when it came to making them for friends, Mr. Hazelgrove very kindly undertook to supply us with sets of castings from our drawings to meet the demand. These castings were, we found, very clean, and the iron used was free-cutting and took a good finish.

With a view to helping the less-experienced worker, we have thought it best to represent the



TOOL POST
TYPE M



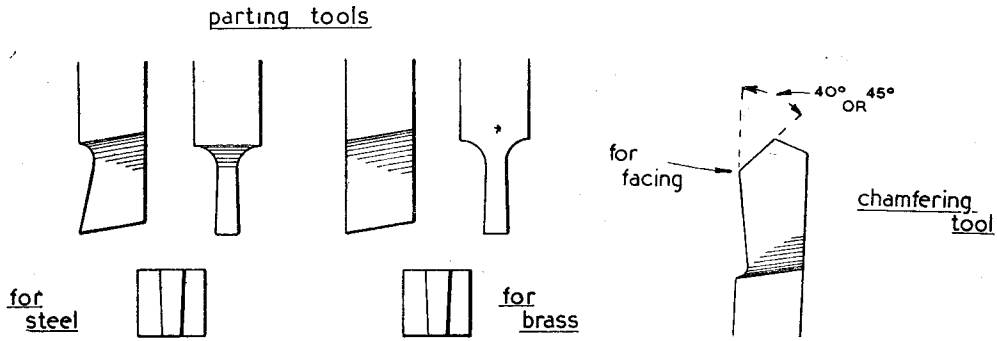
TOOL POST
TYPE D

machining processes in a series of operational drawings which should make clear the way in which the work is carried out as it progresses in a methodical manner from one machining operation to the next.

Although no claim is made that the methods adopted are necessarily the best or the quickest, it will, nevertheless, be found that they are designed to ensure a reasonable degree of accuracy in the finished product, as nothing is left to guesswork and the machining can be checked at every stage.

A set of working drawings is also included which gives the necessary dimensions of the components used in two patterns of tool-posts suitable for lathes of different design.

It will be observed that the difference lies in the position of the holding-down bolts, which are located to conform with the design of the cross-slide and, at the same time, to space the back tool-post at a sufficient working distance from the front post.

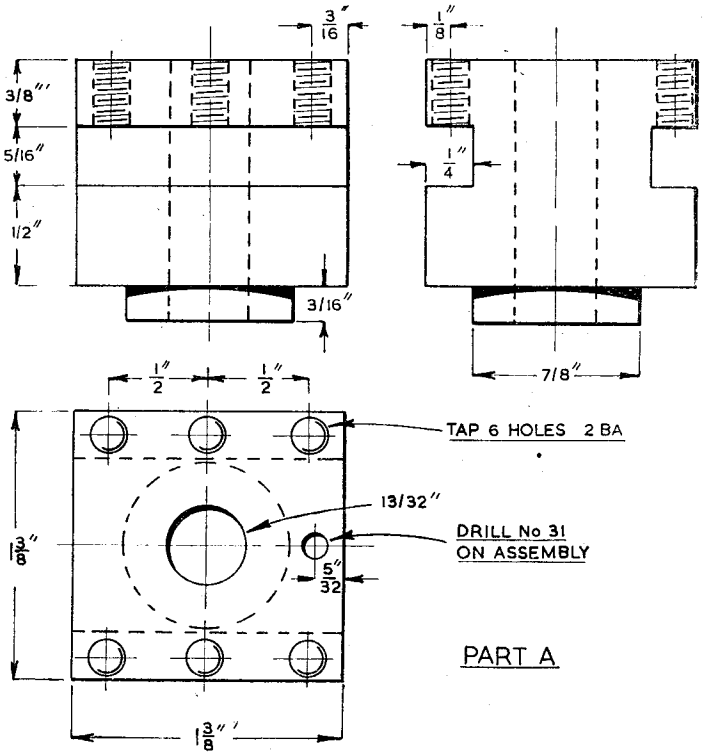


The fitting of a long central bolt is, perhaps, on the whole, preferable and should be used where the T-slots run in a direction across the cross-slide, but the alternative form of attachment has been found entirely satisfactory in practice.

The tool housings are machined to take $\frac{1}{4}$-in. square tools, which are best made of short lengths of ground high-speed steel such as the well-known "Eclipse" brand. The breadth of the parting tool should be between $\frac{1}{16}$ in. and 3/32 in., and the most generally useful tool forms are illustrated in the accompanying drawings. The angle of the chamfering tool can be made either 45 deg. or 40 deg., for the latter is the standard angle generally used for chamfering nuts, bolts and washers.

This tool, if formed as shown in the drawing, can be employed for taking facing cuts to save having to bring the front tool-post into operation when, for example, making a number of washers.

Each tool is clamped in place by three 2-B.A. Allen screws $\frac{3}{8}$ in. in length.



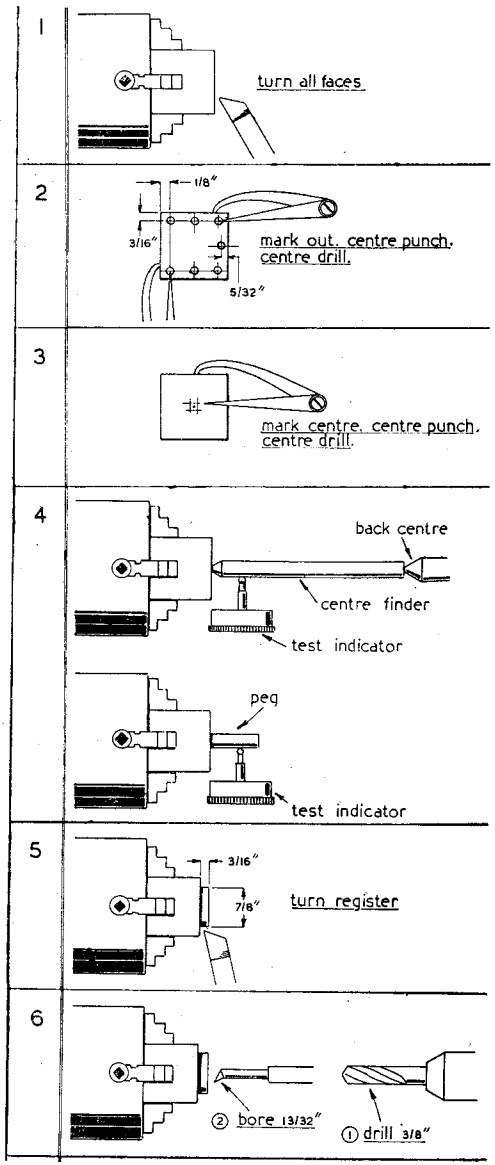
The Turret. A.

It is best to start by machining the turret, for then the exact tool height can readily be adjusted later when machining the upper surface of the base casting.

The turret, when finally in position, should overhang the base casting so that no ledge is left on which chips can collect to interfere with the proper seating of the turret.

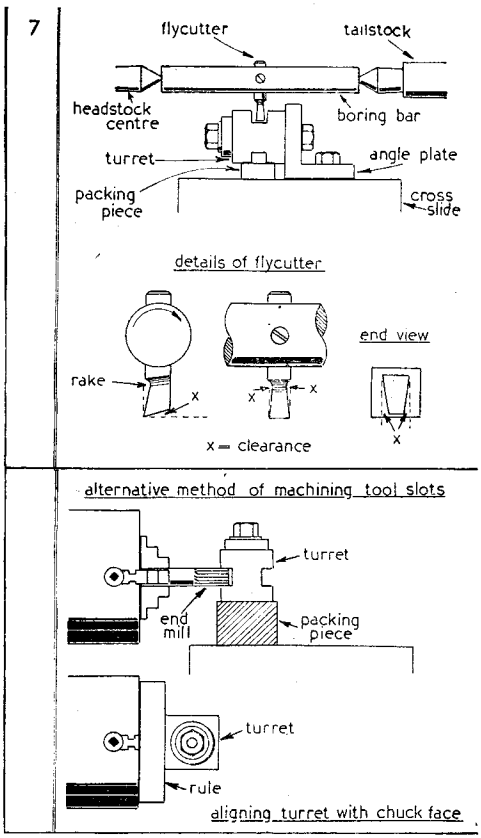
The figures in the text refer to the operations illustrated in the drawings.

(1) The turret is held in the four-jaw chuck and all its surfaces are machined in the lathe. If a tool with a cemented carbide tip is used, all the turning operations described can be carried out without the aid of the backgear.



(2) The casting is removed from the chuck and its upper surface is marked-out with the jenny calipers to indicate the centres of the six 2-B.A. tool clamping screws. After they have been centre-punched, these marks are drilled with a small centre-drill to locate the No. 22 tapping size drill which follows.

To prevent raising the surface of the metal when tapping, the tapping holes are opened out with a $\frac{3}{16}$-in. drill to a depth of about 1/32 in. The holes are then tapped 2-B.A., and any burrs are removed from the upper surface of the casting with a scraper or fine file. At this stage the position of the hole for the register pin is



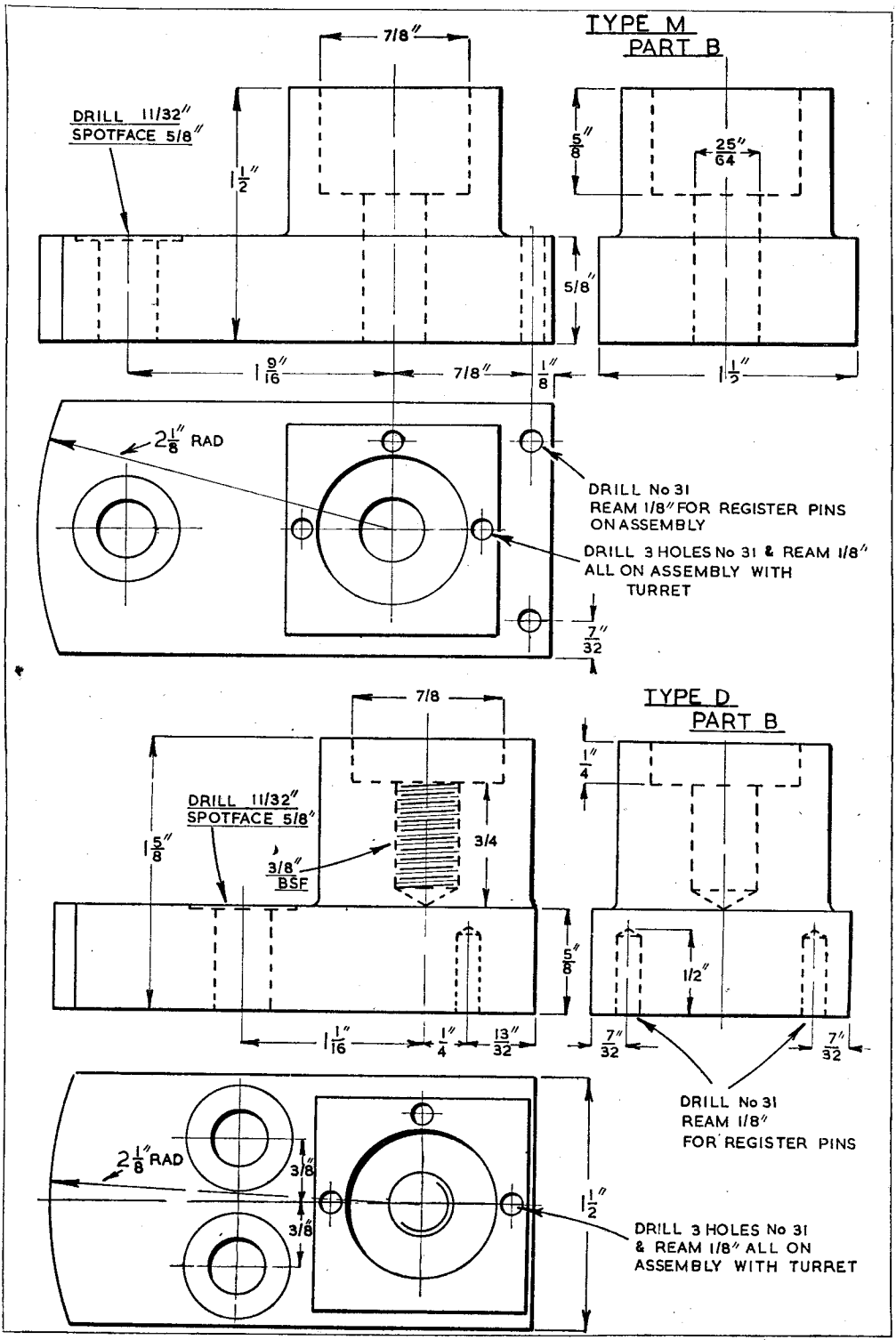
also marked out, and when the centre has been centre-drilled, a No. 31 drill is put right through the casting.

(3) The centre of the lower surface of the casting is marked-out with the jenny calipers and this point is then drilled with a centre-drill.

(4) The turret is again secured in the four-jaw chuck and the centre mark is set to run truly by means of a centre-finder supported by the back centre. If a centre-finder is not available, an $\frac{1}{8}$ in. diameter hole should be drilled at the centre mark prior to mounting the casting in the chuck, and a peg is fitted in the drill hole. This peg can then be set to run truly with the aid of the test indicator.

(5) The register spigot is turned to a diameter of $\frac{7}{8}$ in. and to a length of $\frac{3}{16}$ in.

(6) A central hole is drilled from the tailstock and bored 13/32 in. to provide clearance for the clamping bolt.


TYPE M
PART B
7/8"
DRILL 11/32"
SPOTFACE 5/8"
1 1/2"
5/8"
25/64"
5/8"
1 9/16"
7/8"
1/8"
1 1/2"
2 1/8" RAD
DRILL No 31
REAM 1/8" FOR REGISTER PINS
ON ASSEMBLY
DRILL 3 HOLES No 31 & REAM 1/8"
ALL ON ASSEMBLY WITH
TURRET
7/32"
TYPE D
PART B
7/8
1/4"
DRILL 11/32"
SPOTFACE 5/8"
1 5/8"
3/4
3/8" BSF
5/8"
1/2"
1 1/16"
1/4"
13/32"
7/32"
7/32"
DRILL No 31
REAM 1/8"
FOR REGISTER PINS
2 1/8" RAD
3/8"
3/8"
1 1/2"
DRILL 3 HOLES No 31
& REAM 1/8" ALL ON
ASSEMBLY WITH TURRET

(7) A circular milling cutter or a square-ended fly-cutter is mounted between the lathe centres, and the casting is bolted to an angle-plate set at right-angles to the back edge of the cross-slide. The casting rests on a packing-piece to keep it level and also to set the correct depth of cut.

The bottom and sides of the tool slot are then machined while the work is fed against the run of the cutter, and not in the reverse direction, in order to prevent the tool grabbing.

The slot is formed $\frac{1}{4}$ in. deep and $\frac{5}{16}$ in. wide to provide for height adjustment when later the tool is mounted in the turret.

During machining, the saddle positions are noted on the lead-screw index so that, when the casting is turned over, the second tool slot can be machined in a similar manner to the same dimensions.

As an alternative method, the tool slots can be machined by taking one or more cuts with an end-mill.

For this purpose the casting is clamped to the lathe cross-slide and its height is set by means of a packing-piece, or, to afford a ready means of height adjustment, it can be secured in the machine vice attached to the vertical milling slide.

The turret should be accurately aligned against a rule held in contact with the face of the chuck.

The Base. B.

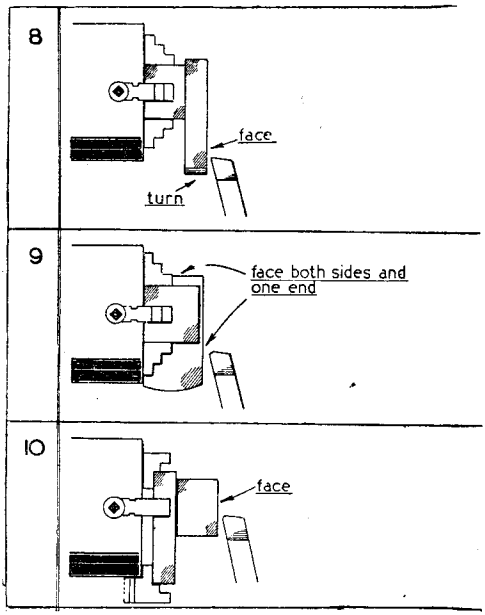
In the drawings, bases of two types are shown : that marked (M) with the long central fixing-bolt is suitable for the Myford M.L.7 lathe, and that indicated by (D) is made to fit the Myford Drummond-type lathe.

For the sake of simplicity, these letters will be used hereafter in the text whenever it is necessary to describe any difference in the machining of the two types.

In the first place, as in all mechanical work of this kind, reference or datum surfaces, as they are termed, must be machined, from which the remaining working surfaces and dimensions can be set out and checked as the machining proceeds.

(8) The base casting is, therefore, mounted in the four-jaw chuck with its pillar approximately central, and the underside of the base is faced flat. The radius at the end of the base is also turned at the same setting.

(9) The three remaining sides of the foot are faced in the same way, and if the casting has been carefully set in the chuck, these should then lie at right-angles to one another.



(10) The casting is replaced in the chuck with its base in contact with the chuck face or jaws, and the upper surface of the pillar is faced flat. The centre of the upper surface of the pillar is then marked-out and centre-punched as illustrated in operation (3).

(*To be continued*)

Reconditioning a "Boley" Lathe

(*Continued from page* 480)

has a 90-tooth wormwheel and a single-start worm, using the 39 division row of holes and moving 45 divisions each time, thus $39 \times 90 = 3{,}510 \div 45 = 78$. Each tenth division has a longer index mark and is numbered in units, starting with 0-1-2-3-4-5-6-7, there being, of course, only 8 divisions between 7 and 0.

I may well be told that it is just as easy to work in decimals of a millimetre as in fractions or decimals of an inch, and that I might have saved myself the trouble.

Well, that may be true to a degree, but when one has worked for fifty years in English units, it becomes second nature, and one instinctively *thinks* in such units and has mentally to convert metric units to them. It is, in any case, a matter for each individual to settle for himself.

A rack has been made for the changewheels (which include a 127-tooth wheel for conversion purposes), whilst the collets, etc., are carried in a fitted drawer below the shelf.

Such things as vertical slide, three-point steady, dividing apparatus, milling spindles, adjustable boring-heads, etc., etc., are carried on the shelf, where they are always in view and do not get a chance to rust unobserved.

"MAID OF KENT" and "MINX"

Firebox Stays

by "L.B.S.C."

I SINCERELY hope that builders of the two 5-in. gauge engines, especially beginners, won't faint when they see the imposing array of firebox stays called for in the construction of the boiler. Probably Inspector Meticulous will make a main-line dash for the saloon bar of the "Coppersmith's Arms," to celebrate this time, as we are getting near full-size practice! Anyway, that is all in order, as the locomotives are a step nearer full-size than most of the engines that have appeared in these notes. Actually, the reason for the large number of stays, is the fact that we are using only 13-gauge copper instead of the usual 10-gauge (⅛ in.); this makes for a more efficient boiler, but requires more careful staying. I carried out a preliminary experiment on "Grosvenor's" boiler before getting out the drawing and specification for "Maid" and "Minx." Having plenty of 18-gauge copper, and not anticipating the building of any more 2½-in. gauge locomotives (not from choice, but because of *Anno Domini*) I made up her boiler with this material, using the one-piece method of construction for firebox wrapper and boiler barrel; and to see if the thinner plates would be satisfactory with adequate staying, I used nearly double the normal quantity of firebox stays, at much closer spacing. Water test to 160 lb. failed to produce any "buttoned cushion" effect, and only slightly moved the recessing in the boiler barrel which I put in to clear the flanges of the driving-wheels, the latter being larger than "scale," because I had the castings in stock and wished to use them up. They are practically the equivalent of 6 ft. 11 in. instead of 6 ft. 9 in. I also took the steam test much higher than the working pressure, 80 lb., and kept it up for about 30 min. but nothing happened, so I guess she's O.K. for service. The few good folk who saw the boiler, won't need any assurance that there weren't any pin-holes in the Sifbronzing, especially around the foundation ring! This job panning out as expected, I just went ahead with the specification for the larger boilers. I'd much rather trust to the results of actual experiment, than any calculations, as I try to design and build locomotive boilers, not steam bombs. With a total of 168 stays in the "Maid's" firebox, and 165 in the "Minx," builders of these engines can rest assured that they won't be taking a sudden trip to the clouds without an aeroplane.

How to Make a Staybolt Tap

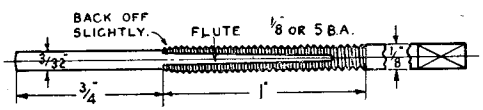
When tapping the holes for the stays in the usual sizes of 2½-in. and 3½-in. gauge boilers, the job can nearly always be done with an ordinary tap with a long taper, which enables the operator to enter the tap and line it up with the opposite hole, before the tap begins to cut deeply. In the present case, with a ⅜-in. water-space to bridge with the tap, the ordinary kind aren't long enough; and if you tap the outer hole, then start wriggling the tap about to start it in the inner hole, it isn't going to do the thread in the soft copper any good, and the stays will be a constant source of trouble through leakage. I might mention here, for beginners' benefit, that trying to bung up a badly-fitting staybolt with soft solder is precious little good; the reason being, that continual expansion and contraction cracks the solder and naturally causes leakage. It was only because soldered joints in loco-type boilers were a constant source of trouble through leakage, that the all-brazed water-tube boiler became so popular in pre-"Live Steam" days, despite the vast waste of heat through the casing. We know better than to solder the joints now!

It is easy enough to make a staybolt tap which will be quite satisfactory for the job in hand. All it needs is a piece of ⅛-in. silver-steel about 3 in. long. Chuck in three-jaw with a little over ¾ in. projecting, and turn down a bare ¾ in. length to 3/32 in. diameter. Drill a No. 41 hole in a bit of sheet-metal, and use as a gauge; when the turned-down part slides easily in the hole, it is correct diameter. Now pull a good inch of the rod from the chuck jaws, and screw this ⅛ in. or 5-B.A.; the latter is best, the thread being finer, and the stays are left a little stronger. Use plenty of cutting-oil for both turning and screwing; when on the latter job, keep working the lathe mandrel back and forth, pulling the belt by hand. Also use a tailstock die-holder; don't on any account attempt to use the die in an ordinary die-stock, which will cause the thread to be out of truth.

The embryo tap can be then fluted or squared. If you have a milling-cutter about 1/16 in. thick, with rounded-off teeth, or if you have a proper tap-fluting cutter (I have; in one of my lucky moments I bought three for sixpence each) the tap can be fluted. To do the job in the lathe, set the tap horizontally in a machine-vice bolted to the lathe saddle, and adjust for height so that the pilot pin just touches the bottom of the cutter when the latter is mounted on a spindle between centres. Run the lathe at slow speed, and feed the tap under the cutter, so that it cuts a groove right to the end of the thread. Repeat operation three times. It doesn't matter about the grooves being spaced to "mike measurements," and you can cut three or four grooves, just as you please. With a small fine file, back off the first three or four threads, then harden and temper just as I described for the cock reamer, except that instead of rubbing it on an oilstone, you'll need to brighten up one of the grooves with a piece of emery-cloth bent double, the bent edge being applied to the flute. Temper until this becomes

light brown, then quench out. The pin must be softened, or it will break off. Clean the pin with a bit of emery-cloth, and apply a red-hot poker or piece of iron bar to it. When it has turned quite blue, quench out in clean water. It won't break then, if ordinary care is used when tapping.

If you can't flute the tap, file four flats on it, tapering off from a perfect square at the pin end, to full threads, in about $\frac{3}{4}$ in. length. Harden and temper as above. Either kind of tap should have a square filed on the plain end, to accommodate a tap-wrench. If these taps are used as below, they will start true threads in the firebox plates, which can be finished with the ordinary second or plug tap.



Staybolt tap

Drilling and Tapping Stayholes

Mark off the location of all the stays on the outside of the shell, and drill them square with same, so that all the stays will go through at right-angles. The job is easy enough on a drilling-machine, though you couldn't drill the holes in backhead and throatplate on the average bench drill, as there isn't enough room between the drill chuck and the table. My own drilling-machine is of the pedestal type, and will take over 2 ft. between the chuck and the lowest position of the table; in addition, I could swing the table around clean out of the way, if needed, so that the floor would be the bottom limit. In my old "first-floor-back" workshop at Norbury, I had a hand-driven bench drill with a swinging table, and I rigged it up with the table overhanging the end of the bench, so that all the space between the chuck and the floor could be made available for drilling lengthy jobs, such as the staybolt holes in the throatplate, backhead, and smokebox tubeplate of a boiler such as I have fitted to the old "Caterpillar," which is of the type the enginemen call "built by the yard."

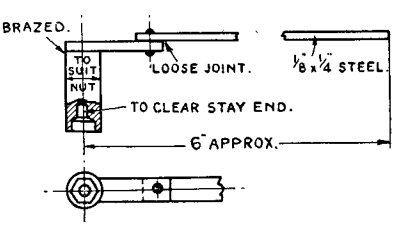
I use an extension drill for getting at the holes in the throatplate, close to the barrel; even if the chuck would clear, the barrel would foul the upper part of the drilling-machine. The extension is merely a bit of $\frac{3}{16}$-in. round rod about 15 in. long, with a stub of No. 41 drill driven into the end of it. This will reach the holes, be clear of the barrel, and allow the chuck to operate beyond the end of same. A nobby gadget to use up a bit of a broken drill!

As the boiler is pretty weighty, it would be a rather awkward job to hold up in position to drill stayholes on the lathe; so if no drilling machine is available, it would be best to drill them by hand. This may appear a tedious and arm-aching job, I grant you; but with a good keen drill, and a dose of cutting-oil applied to it every time you start a fresh hole (keep a drop in a tin lid alongside the job, and dip the drill point in it) they go through quicker than one would anticipate. Also, there is no need to do the lot at one session; when you get tired of drilling, switch on to staybolt making. I got increased production from the boys at the munition shop during the Kaiser's war, by letting them swap jobs as required; boys tire of monotony much quicker than girls. It paid to study human nature!

Put a drop of cutting-oil on the staybolt tap, enter the pilot pin through both the holes in wrapper and firebox, and proceed to tap in the ordinary way, working the tap back and forth with a tap-wrench on the shank. Don't use too big a wrench, or you may break the tap. As the pilot-pin guides the tap, it is impossible for the two tapped holes to be out of line, and the thread will be "continuous," despite the gap between the plates, formed by the water space. As each one is finished, run an ordinary second or plug tap through, still using plenty of cutting-oil. This tap should be sharp; use a new one if possible, but if not, the rounded edge of a gouge-slip pattern oilstone, applied to the flutes, will improve the cutting properties. I usually grind my taps with a weeny grinding-wheel about $1\frac{1}{2}$ in. diameter and $\frac{1}{8}$ in. wide, turning at about 10,000 revolutions per minute; but a tap can be ground on the cutting edges, by judicious application of the flutes to the edge of an ordinary grinding-wheel. If you try this, watch your step, because a 6-in. wheel running at 2,990 r.p.m. (the speed of my Stanley tool-grinder) will have the skin off your knuckles before you realise how close they got! The "follower" tap won't run off the road, but will make a bee-line for the hole in the firebox plate, the thread formed by the pilot tap guiding it in the straight and narrow path.

Making and Fitting Stays

The stays are made from $\frac{1}{8}$-in. soft copper wire or rod. The best stuff I ever used for staybolt making, was intended for Milly Amp, and not Old King Coal at all. Somebody sent me some



Articulated box-spanner

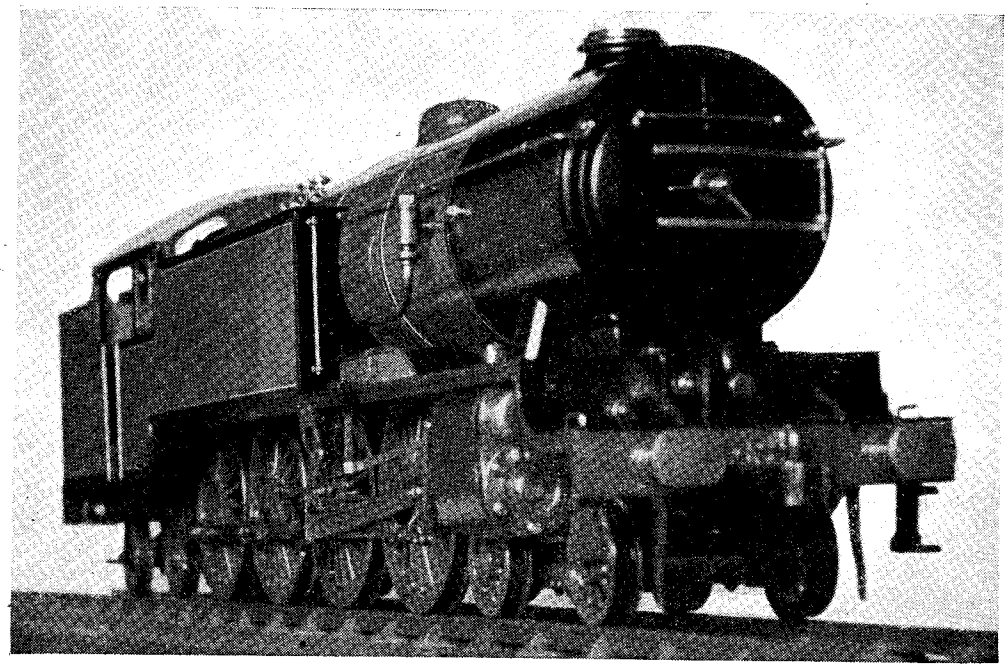
short ends of the stranded cable used for overhead high-tension transmission lines, and when these were unravelled and straightened, the strands were just O.K. for staybolts, being an excellent quality of copper and taking a perfect thread. Ordinary copper wire is usually soft, and can be used as it is after straightening; rod is hard, if of the drawn quality, and needs softening. Cut a number of pieces about 6 in. long, and put a bare $\frac{3}{4}$ in. of $\frac{1}{8}$-in. or 5-B.A. thread on each end, holding the wire or rod in three-jaw, using a die in tailstock holder, and keeping the job well supplied with cutting-oil. At present I am using two parts "Cutmax" to one of ordinary paraffin. Threads should be perfect, both in fit and contour; if you get a torn or broken thread, it

is best policy to throw it away, as it will probably be the start of annoying leakage. For lock-nuts, ordinary commercial brass lock-nuts can be used ; our advertisers sell them.

Put a tap-wrench on the bit of screwed wire, near the thread at one end, insert and screw home. As the wire comes through inside the firebox, hold a nut against the end, and let the wire go through it. Screw down to the end of the thread

heads, as long as they are tight and sound, which is the most important requirement ; Inspector Meticulous can't see through the lagging ! The act of riveting over the head, will automatically flatten any part of the staybolt projecting through the nut. When all the stays are put in, go around all the lock-nuts and give them a final tighten-up.

I have dissertated at length on the staybolt operation, partly for beginners' benefit, and



The original " Helen Long "

on the wire, and snip off, leaving about $\frac{1}{8}$ in. projecting, then tighten up the lock-nut. If any screwed wire projects beyond the lock-nut, snip that off too. The wires can then be re-screwed, and operation repeated, until the whole lot are in. For tightening the lock-nuts, I use a little box-spanner with a crank and connecting-rod on it (see illustration, included for beginners' benefit) ; this is home-made in a very short time. Drill a hole in the end of the rod, to the diameter of the nut across the corners ; put a nut in, and hammer the edge down on to the flats on the nut. The crank is brazed on, and the connecting-rod (bit of steel strip) attached by a loose rivet. You can " articulate " those little useful gadgets known as " Terry " spanners, by the same means, and it is surprising how useful they are for tightening nuts, hexagon-head set-screws and the like, in places under a little locomotive, that couldn't be reached by ordinary means when the engine is erected.

Put a bit of iron bar in the bench vice, letting it project at side, slip the firebox over it, with the end of the staybolt resting on the bar, then rivet over the plain $\frac{1}{8}$-in. of stay outside the wrapper sheet. There is no need to bother about posh

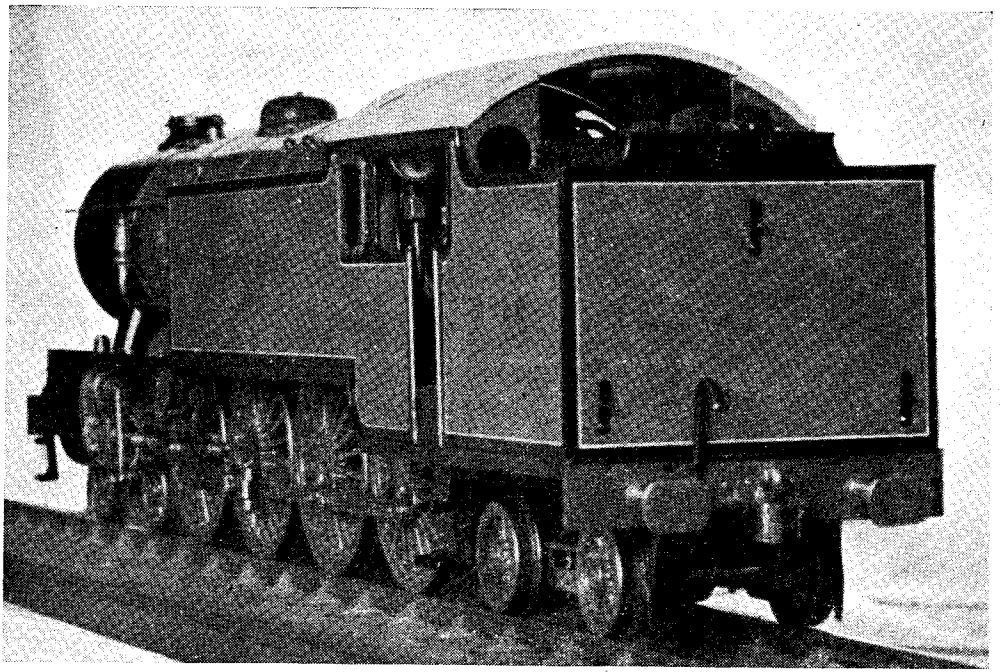
partly because it is perhaps the most vital job in the boiler. A leak in the brazing is easily remedied ; but if the staying is not properly done, something is going to happen, and pretty quick at that, when the engine is steaming fast and putting out her full power. No cause for alarm or apprehension, I hasten to add ; follow instructions, and everything in the garden will be just lovely, but I was taught to be cautious !

Sweating Stayheads and Nuts

If the threads fit the tapped holes in the wrapper, throatplate, backhead and firebox as they should do—that is, tightly, but not tight enough to jam and break off whilst being screwed in—and the lock-nuts are bedded well against the firebox plates, they should be steam- and water-tight without any further treatment ; but it is a precautionary measure to sweat over the whole lot with solder, which acts as a seal for any undetected fault in either stays or tapped holes. This is a simple job. Make a wire brush by driving the end of a bunch of thin iron wires into the end of a short bit of copper tube (scrap end of fire-tube does fine), flattening it, and fitting a wood handle. It gets hot in use ! Lay the boiler in the brazing

pan, and brush some liquid flux, such as Baker's fluid, killed spirits of salts, or commercial chloride of zinc, all over the stayheads and nuts ; then heat up the whole issue to the melting-point of solder. Plumbers' solder is better than tinman's solder for this job, as it has a higher melting-point, but the latter will do. Melt a little in the middle of the stayheads ; and keeping up the heat, brush the liquid solder clean over the whole lot.

boiler and " works," the latter consisting of three cylinders with three separate sets of Walschaerts gear. " Helen " celebrated her coming-of-age by having a general shopping, well earned, and now she sports a new dress. The colour scheme is L.N.E.R. green, with black edging lined out in white. Cab roof is grey. Top of chimney (what there is of it !) bright brass, ditto cab window frames. Wheel tyres and cylinder covers bright



" Helen Long's " " New Look "—note neat lining-out

Keep dipping the wire brush in the flux, but don't inhale the fumes, as they are irritating to the throat. After doing both sides of the wrapper, the heads on the throatplate, and those on the backhead, give all the nuts inside the firebox a dose of the same medicine, turning the boiler about, in the pan, as needed to allow the solder to run around every nut. Don't stint the flux. If the heat is kept up, the solder will penetrate every cranny, sweating well in wherever the flux has been applied. When you are absolutely certain that all heads and nuts have been well covered, pick up the boiler with the big tongs, and hold it until all the surplus solder has drained off. Let it cool until the solder sets, then give it a good wash in running water, scrubbing with an old nailbrush to remove all traces of flux, which would otherwise cause a green corrosion. We are now ready for the pressure test, and all being well, I will deal with that next.

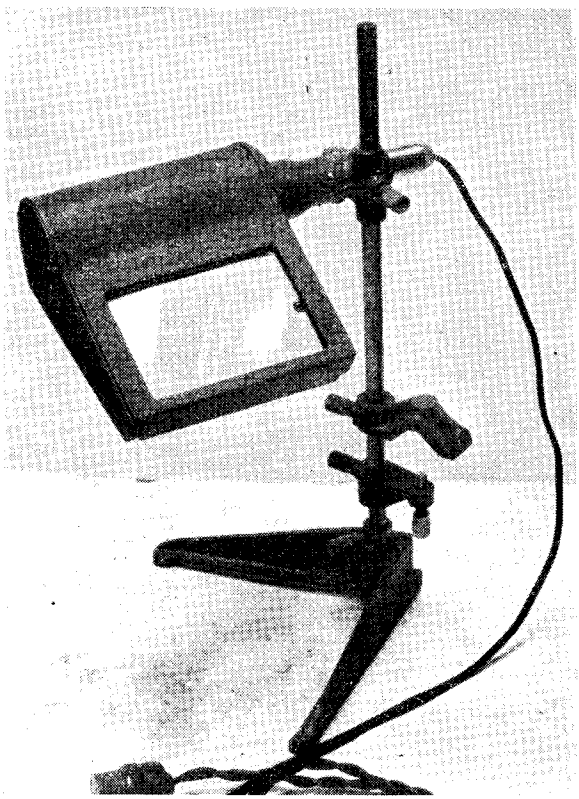
" Helen Long's " " New Look "

Old followers of these notes won't need any introduction to " Helen Long," the 2½-in. gauge " heavyweight " 4-8-4 tank engine with Mr. A. Joslin's outline, and your humble servant's steel. Gold lettering with red lining. The lining, with the exception of the boiler bands, was done with a draughting pen ; the bands were masked with tape after the black had been put on.

The reproduced photographs show the locomotive as she is today. " Live Steamers " keep young ! She looks—and actually is—a mighty powerful box of tricks, and testimony to the fact that a really hefty engine *can* be made to look like a proper locomotive instead of a perambulating spam-can. As a matter of fact she looks better in real life than in the pictures, like my " Tugboat Annie " ; the boiler barrel has a slight taper, and there are other details not apparent.

Mr. Joslin has recently drawn out the most interesting conversion chart that I have ever seen. It is in the form of a graduated circle, with full-size measurements up to 40 ft. Inside this are other circles, with corresponding graduations for 3½-in. down to 1½-in. gauge. Not only can the full-size measurements be converted to the corresponding small size in any of the gauges, but the measurements of, say, a 2½-in. gauge engine can be transposed to 3½ in., at a glance. If all goes well, it is hoped to make blueprints of this ingenious time-saver available in this country.

A Compact Workshop Lens Stand



THE handling and manipulation of instrument parts or other delicate work often calls for the use of a magnifying lens, and in recent years, many ingenious devices have been introduced embodying some form of stand or attachment fixture to carry a lens, with or without the addition of some means of local illumination. Except for work so fine that a very short focus ocular is necessary, the stand carrying a large diameter lens of moderate magnification is found to be most convenient. But many devices of this nature are bulky and of limited adaptability, often taking up room that can ill be spared on a small bench or the table of a machine.

One of the most compact self-illuminating lens stands which we have seen is that recently introduced by the Gordon Instrument Co. Ltd., Clinton Place, William Street, Sheffield, under the name of "Minimag." It embodies a stand with a folding foot, having a $\frac{3}{8}$-in. tubular pillar on which is adjustably mounted a metal hood carrying a rectangular lens $3\frac{1}{2}$ in. $\times$ $2\frac{1}{2}$ in. with a focal length of 8 in., and an illuminating lamp. The latter may be either a standard 25-watt tubular bulb to work on mains voltage with small bayonet holder fitting, or any low-voltage lamp with a similar fitting, such as a car headlamp bulb. Both the height and angle of the hood may be adjusted, and should a further extension of the pillar be required, any length of $\frac{3}{8}$-in. round metal rod may be substituted for the standard pillar supplied. In cases where the magnifier is required to be semi-permanently attached to a drawing board, bench, or any part of a machine, the foot may be removed and a universal clamp fitting substituted, enabling it to be clamped to any flat object up to 4 in. thick, or round object up to 2 in. diameter. The hood is constructed so that it can be mounted and the illuminating lamp inserted either on the left or right of the pillar. When not required, it can be dismantled and stowed in a space only 7 in. $\times$ 6 in. $\times$ 2 in. and the complete outfit weighs under 2 lb.

The main components are made from aluminium die-castings and finished in crystalline enamel. All parts, including the lens, are readily removable and replaceable, and the versatility of the instrument, together with its utility and compactness, enable it to be used in many places where other illuminating or magnifying fixtures cannot conveniently be applied.

Model Louvre Ventilators

Many types of models call for the fitting of small ventilators of the multi-slot or louvre type, and model engineers who have attempted the task of making such ventilators will be well aware that they often present problems, as it is not at all easy to produce clean, evenly-spaced slots, and to bend the metal as required, without general distortion of the surrounding panel.

A range of small louvres has recently been put into production by the Imperia Company, 4, Cranbrook Road, Ilford, Essex, and these are of a type which is usually applied either by soldering or riveting to the panels of model cars, boats or railway rolling stock. They are produced in strips $\frac{1}{2}$ in. wide, having slots $\frac{5}{16}$ in. wide and spaced $\frac{1}{8}$ in. apart. The strips are made with 12, 24 or 36 slots in aluminium or copper, in thicknesses from 0.005 to 0.014 in.

This company also supplies a range of fittings for various types of scale models, also boilers and blowlamps for model steamers. Trade enquiries are invited for these products.

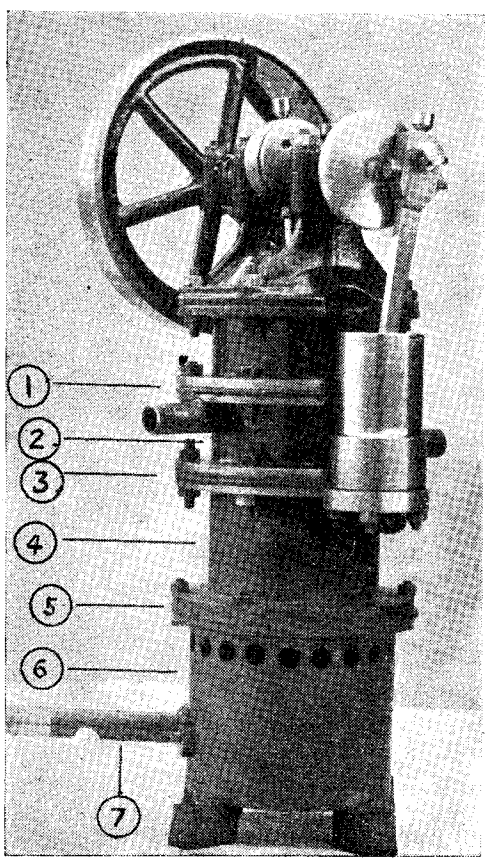
A Successful Hot-Air Engine

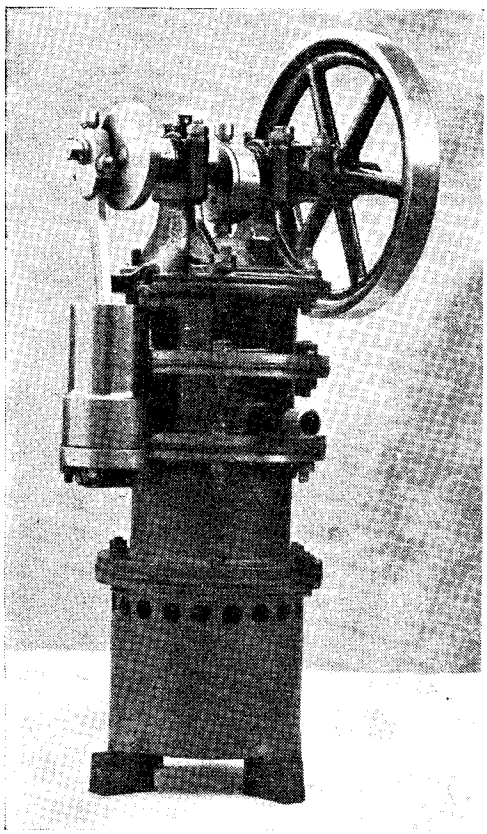
by V. H. Messer (Australia)

READERS will remember the very fine series of articles on hot-air engines by "Artificer," published in THE MODEL ENGINEER during 1940.

I was particularly interested, as many years ago (about 1918) I happened to see an old Heinrici engine operating a petrol-air gas plant.

Carefully running the rule over the job and reducing to such dimensions as could be machined on the round-bed Drummond lathe, which was my only machine tool at that time, I made a small copy with a power cylinder (about 1 in. × 1 in., if I remember correctly). Unfortunately, it turned out a total failure. I suspect the reasons were that the bore of cylinder and fit of piston were not the best, neither was a water jacket fitted. I did once get a few revolutions by wrapping a wet rag around the cylinder! I gave it away soon afterwards.





"Artificer's" thorough treatise caused me to realise the fact that I now had a fairly well-equipped workshop and a good many more years of experience, and perhaps could now make a successful hot-air engine.

So, putting aside other projects, I decided to have a shot at "Artificer's" example on page 310, October 24th, 1940, issue, but half the size; that is, power cylinder $\frac{3}{4}$ in. × 1 in. instead of $1\frac{1}{2}$ in. × 2 in.

Having some scrap steel tubing 2 in. diameter, 20 gauge, and a number of $1\frac{3}{4}$-in. black washers, a start was made. The tubing was cut into lengths and squared up in the lathe; the washers were bored a tight fit for the tubing, and Tobin bronze and oxy torch fixed the four bobbin-like components. The flanges were then faced up in the lathe, and divided up for $\frac{1}{8}$-in. stud holes.

Shown in the photograph are: No. 2, the water jacket; No. 4, the displacer cylinder or "pot," and No. 6, the firebox, the top "bobbin" being just a distance-piece to enable me to use a nice casting, complete with bearings. This casting (dural, I think) came from one of the many gadgets found on the back of a seven-cylinder Bristol radial engine (ex-war disposals). It was just the thing, as the flanged base was the right size and the bearings were bushed to take a $\frac{5}{16}$-in. crankshaft. Between the flanges at No. 1 and No. 3, discs of 20-gauge brass with gaskets

were fitted, the two discs having a bronze guide in the centre (for the displacer rod), secured by fine thread lock-nuts.

Between the flanges at No. 5 is a 20-gauge copper disc and gasket, which is the bottom of displacer cylinder.

Part No. 6, the firebox, has four feet welded on, and a circular gas burner (7) is supported by two screws. This burner used very little gas, the nipple being drilled No. 68. Eighteen holes were drilled around top of firebox to help combustion. Power cylinder and piston were carefully made of C.I., the cylinder being lapped to a very close fit for piston, with no rings. The cylinder base or bottom cover is of mild-steel welded to the top flange of displacer cylinder.

Two $\frac{3}{8}$-in. water pipes were Tobin bronzed into water jacket, and the whole job is very strong indeed. The displacer itself is thin copper tubing with ends silver-soldered, and is very light. A balance-weight is fastened to the 4-in. diameter flywheel, as this was found to be very necessary.

On trial, one or two remarkable things were discovered, on which, perhaps, friend "Artificer" or some other reader can throw some light. No. 1, the fact that the engine runs better when *warm* to *hot* water is used in the jacket is strange indeed. No. 2, it will run perfectly at a regular speed for 15 min., then slow down and sometimes stop, and when restarted by giving flywheel a turn or two, will run again for another 15 min., when the same periodical cycle continues, always every quarter of an hour.

It is fascinating to watch this little job in motion; no valves, no inlet, no exhaust, no sound and no smell; horsepower? No, sir! Blow-fly power perhaps! but one does not expect much from so small a hot-air motor.

For the Bookshelf

Electric Clocks. By S. J. Wise. (London: Heywood & Co. Ltd., Drury House, Russell Street, W.C.2.) Price 10s. 6d.

This book is another useful contribution to the literature of modern horology, being a comprehensive treatise on all forms of clocks operated by electrical motive power, including pendulum or balance wheel types and a.c. mains synchronous clocks. It begins with chapters explaining the elementary principles which govern the operation of electric clocks, the fundamentals of alternating current and the control of mains periodicity; next follows a description of the various types of electric clock escapements, rewinding mechanisms, and synchronous clock motors. In the concluding chapters, the repair and maintenance of electric clocks is dealt with, also descriptions are given of electrically-driven public and turret clocks, and secondary, impulse, or synchronised clock systems as used in factories and offices. The book is well illustrated by line drawings and photographs, and fully up to date in describing the latest developments in this branch of horology.

Glossary of Wood. By Thomas Corkhill. (London: The Nema Press Ltd., 33, Tothill Street, S.W.1.) Price 21s.

In the reviewer's opinion, it is a pity that this book has not been given a title more adequately befitting its scope and contents. For while it is a glossary, in the true sense of the term, containing about 10,000 terms relating to the subject of timber, it is much more than this, as it contains a great deal of information beyond the mere definition of terms. It deals with all aspects of the woodworking trades, from the forest tree to the finished product of the craftsman in all forms of the application of timber. Over 1,000 of the references are illustrated by line drawings, which include practically every form of joint used in the fabrication of timber, typical examples of woodwork styles and methods in architecture, furniture, shop fitting, coachwork, domestic utilities, etc., also the tools and appliances used in woodworking. Undoubtedly, the book is one of the most comprehensive works of its kind ever produced, and invaluable to anyone whose practical work entails any contact with woodwork in any shape or form.

The Science of Clocks and Watches. By A. L. Rawlings. (London: Sir Isaac Pitman & Sons Ltd., Parker Street, W.C.2.) Price 20s.

Of recent years, the subject of horology, which had long been neglected in technical literature, has been given well-deserved attention and some excellent books dealing with the history, science, technique and practice of timekeeping apparatus have made their appearance. It may be that the present-day emphasis on accuracy may have led to this revival, but in any case, it will be welcomed by all who have a technical interest in the design, construction or maintenance of such apparatus. The above book has been written by an eminent American authority and deals in great detail with the essential principles of all devices used for time measurement. In the first chapter, fundamental time observation and units of time are dealt with, followed by chapters on the pendulum, escapements and other impulse devices, electric clocks, balance wheels, marine chronometers, and various mechanical details of watches and clocks. A feature of special interest in the treatment of these subjects is the complete mathematical analysis of periodic and kinematic phenomena; the book may be said to live fully up to its title, in the emphasis which is placed on the scientific aspect of the subject, and it can be recommended as one of the most advanced works thereon which has yet been produced.

Editor's Correspondence

A Model Engineer's Steam Saw-mill

DEAR SIR,—I seldom take up my pen to write to any papers or periodicals, but after seeing a photograph of a saw-bench, in the September 2nd issue of THE MODEL ENGINEER, I felt I just had to write to you. In the interests of model engineers, who may make a similar machine, and have had no experience in the use of these machines, I would like to point out that, in its presented state, it is not much less than a lethal weapon.

There is no guard on the back of the saw, and anyone stumbling over wood or rubbish, and try to save themselves by putting out a hand ; well, I can leave to your imagination what may happen. I have seen this happen, unfortunately.

Now, what of the operator ? If the cut releases stress in the timber and suddenly closes on the saw, there is a good chance of the operator being knocked out. A proper guard will prevent this.

Now look under the bench top. It invites just as much trouble as the top of the saw. Someone may try to pull that box of sawdust out, while the saw is running ; you can guess what may happen here. This may be guarded by two pieces of sheet iron, semi-circular in shape, fixed under top and each side of saw, extending at least 2 in. beyond the teeth of saw. This allows the sawdust to be cleared without danger to the operator.

I have had forty years' experience of all types of woodworking machinery, and I have come to the conclusion that machines have more patience than operators. A machine will watch and wait, year after year, just to catch you off your guard for a fraction of a second and then—it gets you.

Please put a guard on, and don't call me a " Dismal Jimmy."

By the way, I noticed that the boiler, supplying steam to the engine that drives the saw, has a safety-valve fitted. I wonder why ?

Yours faithfully,

New Malden. A. S. BATES.

" Support Home Industry "

DEAR SIR,—I have studied very carefully the contents of the above article, also the previous one entitled " Why Build Your Own Engine," and wish to say I heartily agree with the principles and morals of both, in fact, I myself sincerely believe that the majority of " craftsmen " model engineers will, after quiet reflection, thank Mr. Westbury not only for stating some very true facts as regards present-day car and aircraft activities, but also for his constant and loyal support in many ways to the " petrol " and " c.i." enthusiasts in particular, and model engineers in general.

In case any reader accuses me of " boosting " Mr. Westbury, I would state that through knowing him personally, I also know just a little of the really enormous amount of work and time he devotes (and has done for many years) for the benefit of model engineers in general and to the spirit of model engineering ; this being so, what more natural than that I should take up my pen for a few words on his behalf.

Mr. Bonnette states in his letter that Mr. Westbury is " fussing." I beg to differ, and would say that Mr. Westbury is very sensibly taking the long view, and trying to ensure that both present and future model engineers have a reasonable chance of a square deal. I would also remind Mr. Bonnette that it is due entirely to the efforts and skill of craftsmen model engineers that the competitive events in model car racing were made possible in this country, which in time led to the popularity these events now enjoy. To suggest it is the " masses " who make these competitions possible and successful is a little too much ; as is also the statement that model engineers cannot build and run models.

Has Mr. Bonnette never heard of such model engineers as F. G. Buck, J. Cruickshank, R. Curwen, H. Wainwright, J. Gascoigne, C. W. Field, to mention but a mere half-dozen in the car field alone ; one could name many more (space permitting) of the same class whose activities are an inspiration, and a source of encouragement to all members of the craft.

No, Mr. Bonnette, may I respectfully suggest you tender a little credit where it is due, credit to a man whose aim and ideal is the progressive growth of craftsmanship and the true spirit of model engineering. Yours faithfully,

Leatherhead. F. G. BOLER.

DEAR SIR,—In answer to your correspondent, Mr. S. L. F. Bonnette's criticism of Mr. Westbury's article, I feel, in fairness to E.T.W., I should point out that model car, aeroplane and boat racing owes a great debt to the efforts of the engineering craftsman in his little workshop. I agree that the advent of the super-tuned factory-produced engine has turned two out of three of these hobbies into a competitive sport, and I believe that, although the interest of the competitors are presumably mechanical, as opposed to athletic (although at times I have my doubts, when the model car starters sprint around the track, and various arm exercises are demonstrated in the pits), the chance of the average model engineer competing in these events with any success under the present conditions is a very slender one. There are exceptions, of course, as witness the wonderful performance of Mr. Buck, and some other of our " star " performers in this field. I think far more credit is due to such competitors who build their own engines than to those who enter a model with a commercially-built engine, be it a boat, car or plane, and the constructor-competitor should be given the utmost encouragement.

In the absence of sufficient entries to warrant separate classes, the following scheme, prompted

by Mr. Bonnette's remarks, *re* awarding of bonus points, might be considered. These would be given according to which parts of the model had been constructed by the competitor, and could be confined to main items, such as complete model, engine only, or hull, chassis or fuselage only. In this way, due credit would be given to the man who buys an engine, but constructs the rest of the model.

Hoping these suggestions, if considered, will not give too much of a headache to competition secretaries.

Yours faithfully,

Carshalton. E. A. WALKER.

Club Announcements

Harrow and Wembley Society of Model Engineers

The above society held a very successful exhibition at Wesley Hall, High Road, Wembley, Middx., on October 8th and 9th. The exhibits were in six classes, viz.—locomotives, petrol engines, general, marine, miniature railway and handicrafts.

There were about 120 models displayed, outstanding amongst which were Mr. F. Cottam's now well-known 3½-in. gauge "King" Class G.W. locomotive, and Mr. S. A. Walter's 1-in. scale fire engine and extending Bayley fire escape.

A number of models were entered on loan, some from neighbouring clubs, to whom thanks are due for their support. The Kodak Society of Experimental Engineers and Craftsmen provided a stand containing some very fine examples of members' work.

A novel change from the usual "precision" models were two fine toys made by Mr. C. R. Fox (the exhibition manager), one was a road roller motored by clockwork; the other an automatic sand tipper which conveyed sand tidily down a sharp ramp.

Mr. W. Herridge's 5-in. gauge locomotive was in steam during most of the time, running jacked up to enable onlookers to examine the "works" and ask questions. Several models were running under compressed air.

As an additional feature, a sound film about locomotives, large and small, called "Model Husbands," supported by a Donald Duck exploit, was shown continuously.

Several potential new members asked for entry forms and it is hoped that they will come along to swell the ranks. Interested persons should get in touch with the Secretary, A. D. POLE, 13, Churchfield Close, Woodberry Avenue, North Harrow, Middx. (Harrow 3005.)

Colchester Society of Model and Experimental Engineers

A visit to the Ipswich Society of Model and Experimental Engineers exhibition was arranged for Sunday, October 3rd, by the kind invitation of that society. The occasion was made instructive by the stewards, and we congratulate them for staging such an interesting variety of exhibits.

The lecture for December 7th will be presented by the Rev. W. H. Davies on "Small Scale Steam Locomotives," at St. Mary's Parish Hall, at 7.15 p.m. The Rev. W. H. Davies is our club specialist in this branch of model engineering.

Enquiries for membership of the society will be welcomed and can be obtained from B. D. DOWNES, "Southernwood," Rowhedge Road, Old Heath, Colchester.

The Oldham Society of Model Engineers

During the past weeks the above society has been very active. Lectures dealing with "Designing a Seven-foot Glider," "Building a 2½-in. Lathe," "Armoured Vehicles" and "Man, Physical and Psychic Machine," have been well received and attended. Visits outdoors include Heaton Park, York railway museum and Lindow Common for a combined lakeside regatta with the Altrincham club. In addition, invitations from the Huddersfield and Whitefield clubs provided us with very enjoyable outings, for which we record our appreciation.

Future events are:—

Friday, November 12th. Open Night for Discussion.

Friday, November 26th. Mr. G. Ogden. "Castings in the Home."

As usual, all meetings at King Street Co-operative Society Hall, Room No. 3, at 7.30 p.m. All readers are very welcome at any event.

Hon. Secretary: F. MILLER, 25, Eric Street, Oldham, Lancs.

Welling and District Model and Experimental Engineering Society

The society has commenced an evening class in the fitting and machine shops at Erith Technical Institute on Monday evenings from 7 to 9 p.m., an instructor is provided by the education authority and for that evening the shops are given over to the society's class. The members have concentrated so far on work on the club locomotive and hopes are high on an early completion of it.

In conjunction with the Granada Cinema, Welling, who were showing the film "Berlin Express," the society exhibited some locomotives in the foyer. This roused quite a lot of local interest and received a good mention in the local Press.

The society intends to attend in numbers at the town meetings being held by the local Borough Council to organise local community centres, it being felt that there is a place in such organisations for model societies situated in areas such as ours, where land and buildings are at a premium.

Meetings for November are:—

Friday, 5th. Jumble Sale, 7.45 p.m., Welling Library.

Saturday, 13th. Talk on a Model Cargo Steamer by Mr. A. C. Clark. Parish Room, Belvedere, 7.45 p.m.

Friday, 19th. Film Show by Mr. Holmes. Welling Library, 7.45 p.m.

Saturday, 27th. Informal Meeting. Parish Room, Belvedere.

Hon. Secretary: J. A. KING, 150, Sutherland Avenue, Welling, Kent.

Cranleigh Model Engineering Society

Much interest was aroused in Cranleigh by the above society's first exhibition, held in the Village Hall, on October 1st and 2nd. The show consisted of models from Aldershot, Cranleigh, Dorking, Godalming, Guildford, Staines and Vickers-Armstrong. Also on view was a prototype jet engine lent by the Air Ministry. Outside, a 3½-in. gauge passenger-hauling locomotive proved a great attraction, giving rides to children. Steam and electric locomotives, boats, traction engines, stationary engines, power stations and a cinema machine were among the models displayed, and British Railways gave film shows. Models worked by compressed air, and a centre-piece of a gauge "1" railway were in continuous operation, and attracted much attention. The venture was clearly justified by its educational value and also by the fact that the Cranleigh War Memorial Fund will receive a share of the profits.

Hon. Secretary: KENELM ARMYTAGE, Mossy Copse, Cranleigh, Surrey.

The Leigh and District Model Engineering and Handicrafts Society

Visitors are welcome at all meetings of the above society, which are held every Tuesday evening at the East Leigh Labour Club, Leigh.

We have three members building locomotives (Live Steam), three "OO" gauge enthusiasts, a speed boat fiend, aircraft men and some really fine work shown at most meetings by our wood-turners! Altogether a very busy club.

Hon. Secretary: D. E. CARR, 12, Sanderson's Croft, Leigh, Lancs.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall & Co. Ltd., 23 Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.